54782

NUTTER, McCLENNEN & FISH

ONE INTERNATIONAL PLACE
BOSTON, MASSACHUSETTS 02110-2699

617 439-2000

TELEX: 94-0790 TELECOPIER: 617 973-9748

October 16, 1989
11478-26

By Hand

Mr. Merrill S. Hohman
Director, Waste Management Division
U.S. EPA - Region I
90 Canal Street - 2nd Floor
HAA - CAN 2
Boston, MA

Re: Transmittal of AVX Capping Proposal and Comments on HSFS

Dear Mr. Hohman:

Capping Submittal. On behalf of AVX Corporation ("AVX"), Balsam Environmental Consultants, Inc. ("Balsam") is transmitting to you under separate cover a report entitled "A Remedial Action Program, New Bedford Harbor Superfund Site." Pursuant to my discussion with Charles Bering this afternoon, transmital of this report to you today by Federal Express courier will be timely. The Balsam report is supported by the extensive efforts of numerous other expert consultants. Much of the work of these experts is submitted as appendices to the Balsam report and will be transmitted therewith; Attachments J through M -- the Toxicant Profile for Polychlorinated Biphenyls, the Hazard Evaluation for New Bedford Harbor, the New Bedford Harbor Exposure Assessment, and the New Bedford Harbor Risk Assessment prepared by Terra, Inc. -- are transmitted with this letter along with backup data for Attachment F to the report.

Submission of this report is the culmination of a cooperative process that began last October 19, when the concept of capping as a remedial action alternative was first presented to EPA. Since that date, there have been numerous meetings between EPA and state representatives and representatives of AVX Corporation to exchange technical information and discuss the in place capping alternative. During the course of these discussions EPA invited AVX to submit a detailed description of its alternative. The enclosed

report is submitted in response to this request in supplementation of information supplied to the Agency during these meetings.

The capping submittal is the product of years of effort by a number of the leading experts in their respective fields from across the country. The expertise which has been brought to bear is amply demonstrated by the collective professional distinction and experience found among the contributors to this project. Copies of the resumes of these expert consultants are attached.

The report submitted herewith provides a thorough scientific and engineering basis to demonstrate that the in place containment alternative offers a comprehensive remedial scheme which is protective of human health and the environment, at the same time that it is cost effective. Because every EPA proposal for remedial action evaluated or considered to date has focused on remediation of polychlorinated biphenyls ("PCBs"),[1/] this proposal has a similar focus. However, since one of the key features of this alternative is that it remediates contamination without disturbing sediments, it also provides an effective solution for the broad range of typical estuarine sediment constituents found in New Bedford Harbor, such as metals and polycyclic aromatic hydrocarbons.

AVX believes that the in place containment alternative is a comprehensive remedy which should be selected by the Agency not just for the hot spot but for the rest of the site. The most critical issue to be decided by the Agency at this juncture, however, is whether it is justified in proceeding to remedy the so-called "hot spot" as an operable unit, independent of any indication of what other remediation may be recommended for the site. If the Agency is correct that a decision on overall remedial action will be selected by 1990, the need for hasty action now is questionable.

It is obvious that containment remedies have been given short shrift by the Agency in the HSFS. A comparison of the summary treatment of containment alternatives in the HSFS with

---

1/ See, Fast Track Feasibility Study (EPA 1984); "Overview of Estuary Feasibility Study, Community Work Group Presentation (EPA 1989) (copy attached); "Draft Final Hot Spot Feasibility Study, New Bedford Harbor" (EPA 1989).

the development of the in place capping alternative in the Balsam report reveals at a glance the superficial, conclusory nature of the Agency's approach. Fundamental research, such as study of PCB flux mechanisms (which are relevant even to the government's proposed hot spot remedial alternative and, indeed, to any remedy) was performed by AVX, not the government. Indeed, a review of the documents in the "Sites file" suggests that once the 1984 fast track approach was abandoned, no serious consideration was given to a capping alternative until mid-1987. See, Memorandum of Maggie Leshin to Frank Ciavattieri, May 26, 1987, attached.2/

The state has recommended that capping be retained for further consideration in other portions of the site. See, Transcript of Public Hearing, August 22, 1989. It would be arbitrary and capricious for EPA to assume, on the basis of its limited examination to date, that capping will not be as effective for the hot spot or for any other area to be remediated.3/ Dr. Louis Thibodeaux, a nationally known expert in the field of chemodynamics, has presented a critical evaluation demonstrating the effectiveness of capping as an innovative approach to marine contamination. Sites such as New Bedford Harbor, an estuarine location, are rare among those sites addressed by Superfund. It is consistent with the goal of SARA that unique measures be adopted, or certainly explored in depth. Related to this is EPA's consistent refusal to acknowledge scientific developments regarding biodegradation that unfolded even as EPA spent millions of dollars on studying dredging, a dated technique rife with problems when applied to New Bedford Harbor or any similar Superfund site. Only in the last months and year has EPA come to acknowledge the promise of biodegradation, despite constant urging by defendants for many years. Indeed, the State of New York has halted its plans to dredge the Hudson while biodegradation research proceeds.

2/ This is one example of why the "Sites file" must be included as part of the administrative record. AVX insists that the entire Sites file be incorporated into the administrative record.

3/ It appears from the notes of a 1985 meeting of the Army Corps of Engineers that the Corps has little question about the technical feasibility of a non-dredging alternative. See, Minutes of WES meeting, March 21, 1985, attached. This document is also from the Sites file.

It bears emphasis that the capping plan is not submitted because AVX believes there is a pressing public health or environmental problem that must be addressed. As the risk assessment and three supporting documents by Terra, Inc. demonstrate, EPA has substantially exaggerated the toxicity of PCBs in the New Bedford Harbor area, the exposure conditions to the PCBs, and the risks that could arise from exposure.

In sum, the attached report provides the Agency with an extensive amount of information and provides the basis on which the Agency should decide to stop the ill-fated course of action on which it is now embarked. Any other course of action would be arbitrary and capricious.

Comments on Hot Spot Feasibility Study. Balsam's detailed description of the in place containment alternative is also being submitted as the principal component in AVX's comments on the HSFS. Implicit in AVX's position that the Agency should give capping much more extensive consideration is the necessary conclusion that any decision to proceed with hot spot dredging would be arbitrary and capricious. The hot spot operable unit is based on an artificial division of the site. It is a piecemeal approach to remediation ill-suited to this site, adopted to address delays in studies long ago deemed necessary by the Agency. In the course of a few months, EPA's position fundamentally changed from the view that it was essential to have the results of studies that have been ongoing for years (such as the Battelle model and the EBASCO risk assessment) in order to judge the effectiveness of remedial action, to the position that such studies were unnecessary in order to proceed with the operable unit.

In addition, AVX joins and relies upon the comments submitted by the joint defendants and by Aerovox, Inc. AVX reserves the right to rely upon but not be bound by comments submitted today on behalf of other parties.[4/] Also attached

---

4/ It should be noted that AVX's comments are primarily aimed at questions concerning remediation, not litigation. There are numerous issues that are points of disagreement, not only between AVX and the government, but between AVX and other defendants. AVX's submittal is not intended to waive but rather reserves AVX's position on any of these myriad issues,

(Footnote Continued on Next Page)

for the administrative record is defendants' September 13 letter to Secretary John DeVillars.

AVX believes that unless the various parties who are involved in EPA's administrative proceeding -- the government, the defendants, and the community -- come together to try to reach an affordable solution that solves real and not imaginary problems, studies of New Bedford Harbor, initially commenced in 1976, will never reach an appropriate conclusion. AVX is confident that the Agency will give serious consideration to its submissions. We request a meeting with Agency representatives after there has been an opportunity to review these documents[5/] so that we can discuss this proposal with federal and state representatives in greater detail, as well as those aspects of this project which involve continuing investigation.

Very truly yours,

Mary K Ryan

Mary K. Ryan

MKR/dlh
Enclosures

4/ (Footnote Continued from Previous Page)

whether it concerns the amounts of various Aroclors used at the Aerovox facility or the propriety of attempting to use the Aroclor nomenclature to interpret the GC chromatograms of the environmentally weathered PCBs found in the Harbor. Similarly, the work undertaken to examine flux mechanisms is unrelated to critical issues concerning hydrodynamic circulation and the transport, fate, and contribution to present harbor conditions of contaminants introduced into the environment by Cornell-Dubilier Electronics, Inc., Federal Pacific Electric Company and other third parties, some of whom AVX expects will be named as defendants in the litigation in the future.

5/ In order to facilitate Agency review, additional copies of the Balsam report will be submitted as soon as available.

cc: Frank Ciavattieri (w/o enc.)
Mary Sanderson (w/o enc.)
Charles C. Bering, Esq. (w/o enc.)
Ellen M. Mahan, Esq. (w/o enc.)
Nancy Preis, Esq. (w/o enc.)
Helen Waldorf (w/o enc.)

A

RESUME

WELDON S. BOSWORTH, PH.D.
President/Principal
Senior Consultant - Environmental Impact Analysis

EDUCATION:

Ph.D., Oregon State University, 1976. Zoology
M.S., University of New Hampshire, 1969. Zoology
B.A., University of New Hampshire, 1964. Zoology
MBA Studies, Rivier College (30% Completed)

PROFESSIONAL HISTORY:

1985-Present	Balsam Environmental Consultants, Inc., President
1981-1985	Normandeau Associates, Inc., President
1979-1981	Normandeau Associates, Inc., Executive Vice President
1976-1979	Normandeau Associates, Inc., Vice President, Operations
1972-1976	Normandeau Associates, Inc., Project Manager
1969-1972	Oregon State University, Teaching Assistant
1967-1969	University of New Hampshire, Research Assistant
1964-1967	U. S. Army, Commissioned Officer

SPECIAL SKILLS:

Corporate, operations and financial management.
Management of multidisciplinary environmental studies.
Environmental permitting and impact statements.
Technical writing and editing.
Marine and aquatic ecology.
Sampling design.

REPRESENTATIVE EXPERIENCE:

Executive Management

Fourteen years of progressively increasing responsibility at the executive level for company ranging in size up to 200 professionals and $6,500,000 in annual sales.

Selected Project Experience

NEW BEDFORD HARBOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY AND REMEDIATION DESIGN; 1986 - Present; Principal Scientist. Performed independent evaluation of feasibility study performed by the U. S. Environmental Protection Agency on behalf of AVX Corporation and

completed independent assessments of environmental and transport issues related to natural resource damage and remediation of New Bedford Harbor. Also developed recommendations to address potential adverse impacts of PCB and heavy metal contamination in the harbor.

SEABROOK (NH) ENVIRONMENTAL STUDIES; 1971-1980; Project Manager. Management of large multi-year, multi-discipline baseline study in coastal waters of NH for proposed nuclear generating station. Designed, developed and evaluated sampling program for all biological communities including benthic, fisheries and planktonic; collaborated on design of physical oceanographic studies. Supervised installation and maintenance of over 40 in-situ instruments in nearshore ocean environment. Negotiated work scope with state and federal regulatory agencies; provided expert testimony on environmental impact at over a dozen regulatory hearings at the state and federal level.

LAKE ONTARIO SHORELINE PROTECTION STUDY FOR THE U. S. ARMY CORPS OF ENGINEERS; 1980-1981. Evaluation of impacts of water level changes on shoreline and shoreline structures.

OFFICER-IN-CHARGE; NEW ENGLAND DIVISION, U. S. ARMY CORPS OF ENGINEERS, BASIC ORDERING AGREEMENT; 1978-1980. Coordinated logistics, provided financial management and report review for several projects at various New England harbors to provide information on the impacts of dredging and spoil disposal.

OFFICER-IN-CHARGE; CONTINENTAL OFF-SHORE STRATIGRAPHIC TEST (COST) WELL SITE SURVEYS; GEORGES BANK, BALTIMORE CANYON, GEORGIA EMBAYMENT; 1975-1977. Coordinated logistics, provided financial management and report review for physical and biological studies of OCS test site prior to leasing of offshore areas for exploratory drilling.

OFFICER-IN-CHARGE; BIG RIVER RESERVOIR ENVIRONMENTAL STUDIES. U. S. ARMY CORPS OF ENGINEERS, NEW ENGLAND DIVISION; 1978-1980. Reviewed and edited technical report for impact assessment of a proposed water supply reservoir. Studies included fisheries, wildlife and wetland communities. A wildlife habitat mitigation plan was developed to increase carrying capacity in unaffected areas.

OFFICER-IN-CHARGE; PORTSMOUTH NAVAL SHIPYARD DREDGING EIS FOR U. S. NAVY, NORTHERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND. Subcontracted through Parsons Brinckerhoff, 1976-1978. Helped coordinate logistics, reviewed work plan and reviewed and edited technical reports for development of a candidate EIS for a proposed dredging program at the Portsmouth Naval Shipyard in Kittery,

Maine. The study involved dredging impacts as well as evaluation and selection of both offshore and upland spoil disposal sites.

OFFICER-IN-CHARGE; WEST BRANCH PENOBSCOT RIVER HYDROELECTRIC DEVELOPMENT FOR GREAT NORTHERN PAPER COMPANY, 1981-1983. Collaborated in developing work scope, and reviewed and approved study plans and technical reports for studies of water quality, benthos, and aquatic and terrestrial habitats for FERC Exhibit E for proposed "Big A" hydroelectric facility. Particular attention was focused on using Habitat Evaluation Procedures (HEP) for developing mitigation plans.

OFFICER-IN-CHARGE; DREDGING OPERATIONS MONITORING, HUDSON RIVER. Ports of Albany and North Germantown, U. S. Corps of Engineers, New York District, 1979-1980. Developed sampling plan, coordinated logistics and reviewed and approved reports for study evaluating impacts of dredging operations to planktonic and benthic communities.

OFFICER-IN-CHARGE; KUWAIT WATERFRONT REDEVELOPMENT, HYDROGRAPHIC AND SEDIMENTOLOGICAL STUDIES, MUNICIPALITY OF KUWAIT. Subcontracted through Sasaki Associates, 1977-1978. Coordinated logistics and provided financial management of studies of baseline conditions in nearshore zone of the Kuwait waterfront.

OFFICER-IN-CHARGE; HUDSON RIVER BATHYMETRIC AND SEDIMENT SAMPLING FOR PCB SURVEY, NEW YORK DEPARTMENT OF ENVIRONMENTAL CONSERVATION, 1976-1977. Coordinated logistics, provided financial management and review of deliverables for study, which involved aerial photography and photogrammetric mapping, collection of 700 grab and 200 core samples and analysis of grab samples for grain size and volatile organics.

OFFICER-IN-CHARGE; PEAKS ISLAND (ME), EPA 301h APPLICATION. City of Portland, ME, 1979. Developed sampling plan, coordinated logistics and reviewed technical results for EPA 301h waiver application. Study involved physical oceanographic, marine biological and water quality analysis.

EXPERT TESTIMONY:

Testified before U.S. House of Representatives Subcommittee on Investigations and Review regarding the Federal Water Pollution Control Act (PL 92-500). April 1977.

Lead expert witness on environmental impacts of Seabrook Station at over a dozen State and Federal (U.S. EPA 316(a) and (b) and NRC Atomic Safety and Licensing Board regulatory hearings.

SPECIAL TRAINING:

Strategic Management Seminars. SRI International. 1981-1982.

Certified SCUBA Diver since 1959. Have designed, managed and participated in several scientific diving studies on both the eastern and western U. S. coasts.

OTHER PROFESSIONAL ACTIVITIES:

Participated in OCEANLAB (undersea laboratory) workshop sponsored by New England Marine Advisory Service, 1976.

Invited member to NOAA North and Mid-Atlantic Region Conference on Marine Pollution Studies, 1980.

Executive Board Member, New England Estuarine Research Society, 1976-1980.

Member, Marine Studies Curriculum Advisory Committee, Southern Maine Vocational Technical Institute, 1979-1983.

PUBLICATIONS:

Bosworth, W. S. 1973. Three New Species of Eohaustorius (Amphipoda: Gammaridea) from the Oregon Coast. Crustaceana 25(7):253-260.

Bosworth, W. S. 1976. The Biology of the Genus Eohaustorius (Amphipoda: Haustoridae) on the Oregon Coast. Ph.D. Dissertation. Oregon State University. 200 pp.

Mattice, J. S. and W. S. Bosworth. 1979. A Modified Venturi Suction Sampler for Collecting Corbicula. Progressive Fish Culturist 41(3):121-123.

Bosworth, W. S., J. Germano, D. J. Hartzband, A. J. McCusker and D. C. Rhoads, 1980. Use of Benthic Sediment Profile Photography in Dredging Impact Analysis and Monitoring. IN: Proceedings of the Ninth World Dredging Conference (WODCON IX), 29-31 October 1980, Vancouver, B.C., Canada.

Grabe, S. A., J. W. Shipman, and W. S. Bosworth. 1983. New Hampshire Lobster Larvae Studies. IN: Michael J. Fogarty (Ed), Distribution and Relative Abundance of American Lobster, Homarus americanus, larvae: New England Investiagtions during 1974-1979, p.63-64. NOAA Tech Rep. NMFS SSRF-775.

Authored and/or contributed to over fifty technical reports on various aspects of marine and aquatic communities.

RESUME

LEONARD C. SARAPAS, P. E.
Vice President, Engineering

EDUCATION:

M.S., University of Kansas, 1983. Civil/Environmental Engineering
B.S., University of Kansas, 1976. Civil Engineering

PROFESSIONAL CERTIFICATION:

Registered Professional Engineer: Connecticut, Delaware, Kansas, Maine, Massachusetts, Missouri, New Hampshire, New Jersey, New York, Vermont

PROFESSIONAL HISTORY:

1986-Present	Balsam Environmental Consultants, Inc., Vice President, Engineering
1984-1986	Normandeau Associates, Inc., Manager, Waste Management Engineering
1980-1984	Woodward-Clyde Consultants, Manager, Waste Management Services
1977-1980	Black & Veatch Consulting Engineers, Project Engineer

REPRESENTATIVE EXPERIENCE:

MOTTOLO SUPERFUND SITE REMEDIAL INVESTIGATION/FEASIBILITY STUDY; 1985-Present; Project Manager. Initial stages of this project involved review and critique of site investigations performed by EPA and New Hampshire regulatory agencies, as well as a buried drum exhumation/remedial program. Based upon this review, provided expert testimony in behalf of PRP in litigation involving recovery of remedial costs. Subsequent to that time, a full Superfund RI/FS was initiated including the use of geophysics and remote sensing techniques and the installation of an extensive ground water monitoring network for unconsolidated and consolidated deposits.

U. S. EPA INTERIM SUPERFUND PROGRAM, ZONE 3; 1981-1983; Assistant Project Manager. Managed remedial investigations, feasibility studies and remedial programs for Superfund sites in Missouri, Texas, Iowa and Washington. Developed site investigation and remedial work plans, safety and sampling documents, and engineering evaluation reports.

NEW BEDFORD HARBOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY AND REMEDIATION DESIGN; 1984-Present; Project Manager. Performed independent evaluation of feasibility study performed by EPA on behalf of AVX Corporation and completed independent engineering assessments of environmental, geotechnical and transport issues related to natural resource damage and remediation of New Bedford Harbor. Also developed a program of cost-effective interim remedial measures to address potential adverse impacts of PCB and heavy metal contamination in the harbor and completed study and design of a cost-effective alternative remedial program including in-situ containment and biological degradation.

AMOCO SUGAR CREEK REFINERY RCRA COMPLIANCE; 1980-1984; Project Manager. Provided regulatory compliance and planning to Amoco including development and implementation of a ground water monitoring program, development of closure plans and certification of closure, assessment of property and presentation of findings, and development of a conceptual design for an on-site landfill.

CLEAN HARBORS, INC. FACILITY ASSESSMENT AND REMEDIAL DESIGN; 1985-Present; Project Manager. Performed hydrogeologic and contaminant assessments at two of Clean Harbors, Inc. RCRA TSD facilities, including evaluation of contaminant migration in consolidated and unconsolidated formations underlying facilities. Based upon investigation findings, developed and implemented an agency approved remedial program including source removal and source isolation.

SAVAGE WELL, MILFORD, NH, SUPERFUND SITE; 1984-1986; Project Manager. Performed assessment of ground and surface water quality and identification of contamination source areas related to prior discharge of volatile organic compounds. Using these data, developed conceptual remediation programs including an on-site contaminated soils treatment program and an air stripping treatment system for ground water remediation.

EASTERN MISSOURI TCDD (DIOXIN) SITES; 1982-1984; Project Manager. Managed remedial investigations at eastern Missouri dioxin sites and performed feasibility studies and conceptual design of remedial programs at seven sites. Completed the conceptual design for a 1,000,000-cubic yard regional landfill to hold dioxin wastes.

LINCOLN MILL ASBESTOS REMEDIATION, LINCOLN, NH; 1985-1986; Project Manager. Developed a program to identify, quantify and segregate asbestos wastes and construction debris present at the former Lincoln paper mill. Based on this assessment, a site remediation program was prepared and implemented, including siting and permitting of three on-site

landfills, an air quality monitoring program to document effectiveness of remediation, and a contaminated materials transport and disposal program.

CLOSURE OF BROWNING-FERRIS INDUSTRIES, INC. HAZARDOUS WASTE LANDFILL; 1984; Project Engineer. Designed ground water drainage trench for remediation and closure of a hazardous waste landfill. Assisted in design of landfill cap and ground water monitoring system.

WASTE MANAGEMENT PLAN FOR KANSAS CITY POWER & LIGHT WASTE DISPOSAL AREA; 1980-1981; Project Engineer. Developed cost-reducing closure techniques, ground water monitoring program, waste handling program and permit for a 600-acre coal burning waste disposal site.

RCRA PART B PERMIT APPLICATION FOR CARGILL HAZARDOUS WASTE INCINERATOR AND STORAGE FACILITY; 1983; Senior Consultant. Developed strategy and permit application for Cargill chemical manufacturing hazardous waste incinerator and storage facilities located in southern California.

SOUTHERN NEW HAMPSHIRE MILLYARD FACILITIES REMEDIAL PROGRAM; 1985-1986; Project Manager. Conducted an environmental evaluation of a former tannery/millyard facility to assess feasibility of building renovation. Designed and implemented a facility remedial program including asbestos removal, extensive surface cleaning, decommissioning of underground storage tanks, waste removal, and environmental monitoring. Following program completion, verification sampling was performed to document effectiveness of remedial measures and permit initiation of building renovation.

INVESTIGATION AND REMEDIATION OF ACTIVE THOMPSON HAYWARD CHEMICAL COMPANY PESTICIDE FACILITY; 1983-1984; Project Manager. Determined extent and level of pesticide, dioxin and other organic compound contamination at this active facility, previously used for pesticide formulation. Developed program for remediation of facility to allow continued use of site.

SPECIAL TRAINING:

Chemodynamics - Environmental Fate of Chemical Compounds in Air, Water and Soil; University of Missouri; 1982.

Geotechnical and Geohydrological Aspects of Hazardous Waste Containment; Woodward-Clyde Consultants; 1982.

Hazardous Waste Management Practice Health and Safety Training (40 hours); Woodward-Clyde Consultants; 1984 (Served as Regional WCC Health and Safety Officer).

Assessment of Contaminant Migration in Saturated Materials; Dr. John Cherry, Distinguished Lecturer Series; 1986.

Professional Liability: A Loss Prevention Course; National Society of Professional Engineers; 1988.

PROFESSIONAL AFFILIATIONS:

American Society of Civil Engineers
National Water Well Association
Tau Beta Pi
Chi Epsilon

PUBLICATIONS AND PRESENTATIONS:

"The Potential Impact from Land Application of Waste Water Treatment Plant Sludge on Ground and Surface Water Quality and Soil Characteristics," coauthored with Dr. J. D. Campbell, Kansas Water Pollution Control Association, May 1981.

"Guidance Document for Cleanup of Surface Tank and Drum Sites," coauthored with Jeffrey Cassis, U. S. EPA, August 1984.

"A Practical Approach to Corrective Action Implementation Under the 1984 Hazardous and Solid Waste Amendments," Fifth Annual Hazardous Materials Management Conference, June 1987.

"Case Study of Natural Resource Damage Assessment Litigation at New Bedford Harbor, Massachusetts," First Annual Hazardous Materials Management Conference/Central, March 1988.

"Site Investigation Sampling Guidelines to Protect Sampling Data Defensibility and Admissability," Massachusetts Contingency Legal Education, October 1988.

"HSWA Corrective Action: Status Report for EPA Regions 1, 2 and 3," Seventh Annual Hazardous Materials Management Conference, June 1989.

DR. ROBERT C. JAMES

Dr. Robert C. James received a B.S. in chemistry (1972) and a Ph.D. in Pharmacology (1977) from the University of Utah. He completed post-doctoral training in Toxicology (1979) at the Vanderbilt Medical Center. He is a member of the Society of Toxicology, the Society of Environmental Toxicology and Chemistry, and the Society for Risk Assessment. Dr. James has taught and/or developed undergraduate, graduate, and continuing education programs at several major universities on such subjects as common medicines, pharmacology, general toxicology, industrial toxicology, government regulations, exposure assessment, and risk assessment. Dr. James has published extensively in the area of toxicology, primarily in the areas of chemical biotransformation, the bioactivation and detoxification of chemicals, and the role of xenobiotic metabolism in mechanisms of toxicity. Dr. James has more than ten years of academic research and teaching experience as well as environmental consulting experience. A brief list of the major environmental contamination problems Dr. James has addressed include Love Canal, Hyde Park, Times Beach, Woburn, Texas Eastern compressor stations, and New Bedford Harbor. He has acted as an outside consultant in toxicology to major environmental and engineering consulting firms, the U.S. Dept. of Agriculture, the U.S. Environmental Protection Agency, the U.S. Dept. of Navy, several state departments of environmental protection or public health, state and national trade associations, and numerous law firms. Some of the industrial clients Dr. James has consulted for include Kerr-McGee, DOW Chemical Company, Monsanto, Velsicol, Chevron Oil Company, General Electric, W.R. Grace Company, PPG, Union Pacific Railroad, and Southern Pacific Railroad. As a consulting toxicologist Dr. James has developed and managed medical monitoring programs. He has performed qualitative and quantitative hazard assessments, exposure assessments, and risk assessments used to evaluate public health and worker safety, or to establish acceptable contaminant guidelines, for air, soil, sediments, water or building surfaces. He has critiqued and commented on such public policy matters as regulatory procedures or specific agency regulations concerning chemical contaminants, and provided scientific support to personal injury and class action litigations on such issues as exposure, cancer risks, chemical hazards, and the basis of expert testimony. These assessments and evaluations have dealt with PCBs, polychlorinated dibenzodioxins and dibenzofurans, phenolic compounds and chlorinated phenols, heavy metals, PAHs, nitrosamines, formaldehyde, benzene and other aromatic hydrocarbons, and numerous halogenated aliphatics (e.g., trichloroethane, carbon tetrachloride, methyl bromide, etc.).

DR. RICHARD W. FREEMAN

Dr. Richard W. Freeman has fourteen years experience in research, academic and regulatory toxicology. He received his B.S. degree in biology from the University of Alabama in 1966 and completed work towards his M.S. degree in biology from the University of Alabama (1975) while employed at Southern Research Institute on projects related to pre-clinical toxicity testing of candidate anti-tumor drugs. His doctorate in Pharmacology was awarded by Vanderbilt University in 1980 where Dr. Freeman researched bioactivation of two nitrogen-containing drugs, cocaine and procainamide. Following his post doctoral work at Vanderbilt, Dr. Freeman held an academic position at the University of Arkansas for Medical Sciences in the Interdisciplinary Toxicology Program (1981-1985) and was director of the Toxicology and Hazard Section for the Florida Department of Health and Rehabilitative Services. He has published 18 peer-reviewed journal articles in the field of toxicology, primarily in the area of toxic bioactivation of drugs and xenobiotics. He has prepared course material for pharmacology and toxicology on general principles, metabolism, pharmacokinetics and metal toxicology. As the state toxicologist for Florida, Dr. Freeman touched all aspects of toxicology from analysis of acute toxic exposures to risk assessment and exposure standard setting. He has advised other state agencies on evaluations of environmental exposures and has provided expert testimony for the state on environmental issues. He has experience supervising large statewide programs for toxicological assistance to local government units, exposure assessment from leaking underground petroleum storage tanks and a survey of waste quality in 3,500 randomly selected private drinking water wells.

DR. ALAN C. NYE

Dr. Alan Nye received a doctorate in Toxicology from the University of Arkansas for Medical Sciences where he completed research in the area of heavy metal toxicity. He has also conducted post-doctoral training at Duke University School of Medicine and has published in the area of mechanisms of chemical-induced cytotoxicity. He is a member of the Society for Risk Analysis. Dr. Nye has worked as a toxicologist for S&ME, Inc., a major consulting engineering firm. His work at S&ME included preparation of public health assessments for Superfund sites, service as advisor in the area of employee health and safety, preparation of hazardous waste site health and safety plans, teaching basic toxicological principles and site health and safety to new professional employees, and the collection of soil and water samples at hazardous waste sites. At TERRA, Dr. Nye has evaluated human health risks and environmental harm on several superfund sites for both regulatory agencies and industry. He has completed several exposure and risk assessments concerning dioxins, PCBs, agent-orange, chlorinated solvents, and heavy metals. He has prepared toxicant profiles and toxicological evaluations for various chemical constituents in commercial products. He has also prepared and successfully defended risk assessments used to negotiate alternative concentrations for clean-up actions. Dr. Nye has considerable experience evaluating toxicity testing data for its strengths and weaknesses. In this capacity, he has critically reviewed epidemiological studies and public health surveys. In the area of litigation support, Dr. Nye has managed several technical assistance projects concerning the evaluation of personal injuries associated with exposure to chemical contaminants in air, water, and soil. Further, he has assisted in evaluation of the public health risks associated with habitation of contaminated buildings. He has prepared and presented comments involving policy and regulations concerning chemical constituents at public hearings.

DR. STEPHEN M. ROBERTS

Dr. Stephen Roberts received a B.S. degree in Pharmacy (1973) from Oregon State University and a Ph.D. in Pharmacology (1977) from the University of Utah College of Medicine. He completed a post-doctoral fellowship in pharmacokinetics at the State University of New York at Buffalo (1980), and served on the faculty of the University of Cincinnati (1980-1986) where he still holds an adjunct appointment as an Asst. Professor of Pharmacology and Toxicology in the College of Pharmacy. From 1986 to 1989, he was a member of the faculty of the Division of Interdisciplinary Toxicology, College of Medicine, University of Arkansas for Medical Sciences, and is presently Director of Research and Development, Center for Environmental Toxicology at the University of Florida. Dr. Roberts is a member of the Society of Toxicology, the American Academy of Clinical Toxicology, the Socity for Risk Analysis, and the International Society of the Study of Xenobiotics. He has had extensive experience in creating and teaching courses in Toxicology, primarily at the graduate level. Such courses include topics in clinical, environmental, and regulatory toxicology, as well as risk assessment. Additionally, he has supervised the research leading to the Ph.D. or M.S. degree for a number of students in graduate programs. Dr. Roberts has numerous publications in areas of research related to the metabolism and disposition of toxicants, mechanisms of toxicity, and toxic effects of chemicals on the immune system. He also has extensive experience in the area of toxicokinetics (which deals with the absorption, distribution, metabolism, and excretion of harmful chemicals). Dr. Roberts has authored or co-authored toxicant profiles on several compounds, and has provided critical review of research and literature in the context of public policy decisions and regulatory matters. He has participated in the preparation and review of numerous risk assessments, endangerment assessments, and public health assessments for several Superfund sites.

RESUME
(Revised 5/1/86)

Louis Joseph Thibodeaux
Professor of Chemical Engineering
Louisiana State University
Baton Rouge, LA 70803
Phone (504) 388-1426

PERSONNEL DATA

Date of birth: November 13, 1939
Place of birth: Church Point, Louisiana
Home address: 3449 Tezcucco Drive, Baton Rouge, LA 70808
Wife: Elwana Joyce Lasiter
Place of birth: Wewoka, Oklahoma
Children: Jason Scott born August 8, 1961
Michelle Reneee born April 21, 1964
Hobbies: sailing, history, travel, hunting, country music
Social Security No.: 437-60-2801

EDUCATION

Ph.D., Chemical Engineering, Louisiana State University, 1968
M.S., Chemical Engineering, Louisiana State University, 1966
B.S., Petroleum-Chemical Engineering, Louisiana State University, 1962 (five-year course equivalent to separate degrees in each discipline).

PROFESSIONAL EXPERIENCE

Academic

Professor of Chemical Engineering and Director of Hazardous Waste Research Center, Louisiana State University; August 1984 to present
Professor of Chemical Engineering, University of Arkansas; July 1977 to August 1984
Visiting Professor of Chemical Engineering, University of Exeter, Exeter, England; January to June 1983
Associate Professor of Chemical Engineering, University of Arkansas; July 1972 to Jyly 1977
Visiting Professor of Chemical Engineering, Oregon State University; August 1974 to January 1975
Assistant Professor, Chemical Engineering, University of Arkansas; January 1968 to July 1972
Assistant Professor, Civil Engineering (Environmental), University of Arkansas; Summer 1969, 1971
Research Assistant, National Council for Air and Stream Improvement, Division Engineering Research; Louisiana State University, Baton Rouge; June 1965 to February 1968
Research Assistant, Institute of Saline Studies, Division Engineering Research; Louisiana State University, Baton Rouge; September 1964 to June 1965.

Consulting and Expert Witnessing

Battelle Institute, 1985
Fred G. Hart, Associates, NY, 1984
Anderson-Nichols, Palo Alto, CA, 1984
Proctor and Gamble, Cincinnati, OH, 1984,1986
Lawler, Matusky & Skelly, NY, 1985
Weyerhaeuser, Tacoma, WA, 1985
Great Lakes Chemical, EL Dorado, AR, 1983
U.S. Corps of Engineers, Tacoma, WA, 1983
Ethyl Corporation, Baton Rouge, LA 1983-1984
Ethyl, Exxon, Dow, Petroprocessor vs USEPA, Baton Rouge, LA 1983
Arkansas Department Pollution Control and Ecology, USEPA vs Vertac Chemical, Little Rock, AR, 1979-1980
Exxon Research and Egnineering Company, Florham Park, NJ, 1979
ESCOM Laboratory, Fayetteville, Arkansas, 1979
McClelland Consulting Engineers, Fayetteville, Arkansas, 1979
Monsanto Chemical Company, ElDorado, Arkansas, 1976
Zero Mountain, Johnson, Arkansas, 1972
Northwest Arkansas Regional Planning Commission, Springdale, Arkansas, 1971-72
Daisy/Heddon, Rogers, Arkansas, 1971
National Rejectors, Industries, Hot Springs, Arkansas, 1971
Georgia Kraft Company, Rome Georgia, 1968-70

Full-time and Summer

International Paper Company, Natchez, MI; Summer, 1970
Georgia Kraft Company (Mead Corporation), Rome GA; Summer 1968 and 1969
National Council Air and Stream Improvement, Baton Rouge, LA; Summers 1965, 1966, and 1967
U.S. Rubber Company, Scotts Bluff, LA; Summer 1964
E. I. duPont de Nemours and Company; Aiken, S.C.; June 1962 to February 1964

Organizations Memberships

American Institute of Chemical Engineers
  Technical Session Chair: 1974, 1983 to 1986
  Environmental Division Officer;
    Secretary, 1981
    Treasurer, 1982-1983
    Second Vice Chairman, 1984
    First Vice Chairman, 1985
    Chairman, 1986
American Chemical Society
  Technical Session Chair: Miami, 1985, San Francisco, 1976
American Water Resources Association
  Meeting Program Chair (Ark. Section), 1972-1975
  President (Ark. Section), 1975
American Association Advancement of Science
American Association University Professors
Air Pollution Control Association
American Society Engineering Education
Society of Environmental Toxicology and Chemistry

Registrations
Arkansas No. 4114
Louisiana No. 11762

TEACHING AND EDUCATION EXPERIENCE

Undergraduate Courses
Chemical Processes and Kinetics
Mass Transfer Principles
Mass Transfer Applications

Graduate Courses
Advanced Mathematics for Chemical Engineers
Transport Phenomena (Mass)
Advanced Reactor Design
Environmental Chemical Engineering (Chemodynamics)

Graduate Research Advisory
Thesis advisory to 33 Masters Degree students
Dissertation advisor to 3 Ph.D. Degree students

Continuing Education
4 Environmental Chemical Engineering courses (1969, 1971, 1979, 1981)
20 Chemodynamics short courses (1981 to 1986)
10 under AIChE sponsorship
8 under University Missouri-Columbia sponsorhip
4 respectively University of Arkansas, L.S.U. (2) and EPA
1 Workshop Lecturer, American Petroleum Institute, Modeling of Toxics (1985)

Committees and University Service
University Committees and Related Activities
Student Relations Committee-member
Hazardous Waste Committee-member
UA Chapter Xi-president
UA Chapter Xi-White paper to President of UA on Research-co-author
ORSP/ Xi Research Proposal-Writing Seminar/Workshop-March 14-15, 1977 co-chairman
University Research Council-member
Graduate Council-member

College of Engineering Committees
Service Course Committee
Tenure Committee
Computer Use (ad hoc)
Graduate curriculum committee
Engineering Math (ad hoc)

Department of Chemical Engineering
Department Directions in Research (ad hoc)
Graduate Studies-co-chairman

CONTRIBUTIONS TO TECHNICAL LITERATURE

Doctoral Dissertation

"Ion-Exchange Resin Diffusion Coefficients and Resin Phase Ion Diffusivities", Jesse Coates, Advisory, Louisiana State University, Baton Rouge, 1968.

Book

CHEMODYNAMICS - Environmental Movement of Chemicals in Air, Water, and Soil, John Wiley, New York, (1979), 501 p.

Book Chapters

Thibodeaux, L.J., "Identifying Knowledge Gaps on Land/Soil Processes: Hazardous Substance and the Land/Soil Resource", Chapter in Geochemical and Hydrologic Processes and Their Protection, Greenwood Press, NY (1987).

Thibodeaux, L. J., and H. D. Scott, Chapter 4, Air/Soil Exchange Coefficients, in Environmental Exposure from Chemicals, Volume I, W. Brock Neely and G. E. Blau, Editors, CRC Press, Inc., Boca Raton, FL (1985).

Thibodeaux, L. J., C. Springer and S. Chatrathi, Chapter 17, Simulation Study of the Volatization of Polychlorinated Biphenyls from Landfill Disposal Sites, in Environmental and Solid Waste, C. W. Francis and S. I. Auerbach, Editors, Butterworth Publishers, Woburn, MA (1983).

Thibodeaux, L. J., Chapter 5, Offsite Transport of 2,3,7,8-Tetrachlorodibenzo-p-dioxin from a Production Disposal Facility, in Chlorinated Dioxins and Dibenzofurans in the Total Environment, G. Choudhary, L. H. Keith and C. Rappe, Editors, Butterworth Publishers, Woburn, MA (1983).

Thibodeaux, L. J., L. K. Chang, D. J. Lewis, "Dissolution Rates of Organic Contaminants Located at the Sediment Interface of Rivers Streams, and Tidal Zones," Chapter 16 in Contaminants and Sediments, Vol. 1, R. A. Baker, Ed., Ann Arbor Science, Michigan, (1980).

Journal Articles

Springer, C., K.T. Valsaraj and L.J. Thibodeaux, "The Use of Floating Oil Covers to Control Volatile Chemical Emissions from Surface Impoundments: Laboratory Investigations", Hazardous Waste & Hazardous Materials, Vol. 2, No.4, 1985. p. 487.

Lunney, P. D., C. Springer and L. J. Thibodeaux, "Liquid-Phase Mass Transfer Coefficients for Surface Impoundments," Environmental Progress, Vol. 4, No. 3, Aug. 1985, p. 203.

Thibodeaux, L. J., and D. Lipsky, "A fate and Transport Model for 2, 3, 7, 8 - tetrachlorodibenzo-p-dioxin in Fly Ash on Soil and Urban Surfaces," Hazardous Waste and Hazardous Materials, Vol. 2, No. 2, 1985.

Journal Articles: (continued)

Thibodeaux, L. J., C. Springer and R. S. Parker, "Design for Control of Volatile Chemical Emissions from Surface Impoundments," Hazardous Waste and Hazardous Materials, Vol. 2, No. 1, 1985.

Thibodeaux, L. J., D. G. Parker and H. Heck, "Chemical Emissions from Surface Impoundments", Environmental Progress, Vol. 3, NO. 2, May 1984, p. 73.

Hwang, S., and L. J. Thibodeaux, "Measuring Volatile Chemical Emission Rates from Large Waste Disposal Facilities," Environmental Progress, Vol. 2, No. 2, May 1983, p. 81.

Thibodeaux, L. J., and B. Becker, "Chemical Transport Rates Near the Sediment in Wastewater Impoundments, "Environmental Progress, Vol. 1, No. 4, Nov. 1982, p. 296.

Thibodeaux, L. J., and P. S. Christy, "Spill of Soluble, High Density, Immiscible Chemicals In Rivers," Environmental Progress Vol. 1, No. 2, May, 1982, p. 12.

Thibodeaux, L. J., and S. Hwang, "A Model for Volatile Chemical Emmissions to Air from Landfarming of Oily Waste," Environmental Progress Vol. 1, No. 1, Feb. 1982, p. 42.

Thibodeaux, L. J., C. Springer and L. M. Riley, "Models of Mechanisms for the Vapor Phase Emission of Hazardous Chemicals from Landfills, "Journal Hazardous Materials, 7(1982) 63-74.

Thibodeaux, L. J., "Estimating the Air Emissions of Chemicals from Landfills, "Jo. Haz. Materials, 4 (1981) 235-244.

Thibodeaux, L. J., "Fluid Dynamic Observations on a Packed Crossflow Cascade at High Loadings,"Ind. Eng. Chem. Process Des. Dev., (1980) Vol. 19, 33-40.

Thibodeaux, L. J., K. Pittaway, "Measurements of the Oxygen Desorption Rate in a Single Stage Crossflow Packed Tower," Ind. Eng. Chem. Process Res. Dev., (1980), Vol. 19, p. 40-46.

Thibodeaux, L. J., J. D. Millican, "Quantity and Relative Desorption Rates of Air-Strippable Organics in Industrial Wastewater," Env. Sci. Tech., Vol. 11, No. 9, (September 1977), p. 879.

Thibodeaux, L. J., "Mechanisms and Idealized Dissolution Modes for High Density (p 1), Immiscible Chemicals Spilled in Flowing Water," AIChE Jo., Vol. 23, Nov 4, (July 1977), p. 544-553.

Thibodeaux, L. J., D. R. Daner, A. Kimura, J. D. Millican and R. J. Parikh, "Mass Transfer Units in Single and Multiple Stage Packed Bed, Cross-Flow Devices," Ind. Eng. Chem. Process Design and Development, Vol. 16, No. 3, (1977), p. 325.

Thibodeaux, L. J., and C. K. Chen, "A Fickian Analysis of Lake Sediment Upsurge, "Water Resources Bulletin, Vol. 12, No. 2, April 1976.

Journal Articles: (continued)

Thibodeaux, L. J., "Semi-Infinite Solid Model for Prediction of Temperature in Deep Reservoirs and Lakes,"Water Resources Bulletin, Vol. 11, No. 3, June 1975.

Thibodeaux, L. J., R. E. Estridge, B. G. Turner and R. L. Smathers, "Treatment of Selected Kraft Mill Waste in Cooling Towers," TAPPI, 54, 1, p. 53 (1971).

Thibodeaux, L. J., "Continuous Corsscurrent Mass Transfer in Towers," Chemical Engineering, Vol. 75, No. 12, June 1969, pp. 165-170.

Thibodeaux, L. J., P. W. Murrill, "Comparing Packed and Plate Columns," Chemical Engineering, July 18, 1966.

Proceedings (Manuscript Published)

C. Springer, K.T. Valsaraj and L.J. Thibodeaux, "Laboratory Investigations of In-situ Emission Control Methods for Surface Impoundments", Manuscript No. 85-70.2, 78th Annual Air Pollution Control Association Mtg., Detroit, 1985.

Thibodeaux, L.J., D.D. Reible and C.S. Fang, "Transport of Chemical Contaminants in the Marine Environment Originating from Offshore Drilling Bottom Deposits - A Vignette Model", Workshop - Pollutant Transport and Accumulation in a Multimedia Environment, NCITR, UCLA, January 21-24, 1986, Santa Monica, CA.

Thibodeaux, L.J., R.S. Parker and C. Springer, "Design for Control of Volatile Chemical Emissions from Surface Impoundments", 2nd International Symposium. on Emerging Hazardous Waste Management Technologies, Odense, Denmark, September 11-16, 1984

Thibodeaux, L.J., "Chemodynamics of Hazardous Waste Treatment - The Volatile Organic Emission Problem", Proceedings of the Corn Refiners Association Scientific Conference, St. Charles, Illinois, June 26-28, 1984.

Savant, S.A., D.D. Reible, G.S. Gipson, J.D. Boyle and L.J. Thibodeaux, "An Investigation of the Significance of Convective Transport in River Sediments", to be published in the Proceedings of the 24th Hanford Life Sciences Symposium, Health and Environmental Research on Complex Organic Mixtures, Seattle, Washington.

Springer, C., L. J. Thibodeaux and T. Hedden, "Thermal Effects on the Emmision of Volatile Organic Chemicals from Surface Waste-Water Impoundments in the Absence of Wind: Laboratory Measurements," Paper No. 84-3.4, Proceedings Air Pollution Control Association Conference, San Francisco, CA, June 1984.

Hildebrand, G., C. Springer and L.J. Thibodeaux, "A Pilot Scale Study of Volatile Organic Chemicals from Landfills", 77 Annual Meeting of the Air Pollution Control Association, San Francisco, CA, June 24-29, 1984.

Proceedings (Manuscripts Published): (continued)

Carvanos, J., G. H. Sewell, T. Shen and L. J. Thibodeaux, "Validation of Mathematical Models Predicting the Airborne Chemical Emmision Rates From Saturated Soils," Paper No. 85-73.4, Proceedings 78th Air Pollution Control Association Conference, Detroit, 1985.

Springer, C., K. T. Valsaroj and L. J. Thibodeaux, "Laboratory Investigations of In-situ Emission Control Methods for Surface Impoundments," Proceedings 78th Air Pollution Control Association, Detroit, MI, 1985.

Thibodeaux, L. J., C. Springer and R. S. Parker, "Volatile Organic Emissions Reductions from Surface Impoundments by the use of Wind fences and Wind Barriers," Proceedings 11th Annual EPA Research Symposium, Cinn., OH, April, 1985.

Thibodeaux, L. J., C. Springer, and G. Hildebrand, "Air Emissions of Volatile Organic Chemicals From Landfills-A Pilot-Scale Study," 10th Annual Research Symposium, USEPA, Ft. Mitchell, KY, April 2-5, 1984.

Springer, C., L. J. Thibodeaux, P. D. Lunney and R. S. Parker, "Secondary Emissions from Hazardous Waste Disposal Lagoons: Field Measurements," 9th Annual Research Symposium, USEPA, Ft. Mitchell, KY, May 2-4, 1983.

Thibodeaux, L. J., C. Springer, P. Lunney, S. C. James and T.T. Shen, "Air Emissions Monitoring of Hazardous Waste Sites," Proceedings National Conference on Management of Uncontrolled Hazardous Waste Sites, Hazardous Materials Control Research Institute, Silver Spring, Maryland, 1982, p. 70-75.

Thibodeaux, L. J., C. Springer, T. Hedden and P. Lunney, "Chemical Volatilization Mechanisms from Surface Impoundments in the Absence of Wind," Proceedings of 8th Annual Research Symposium, U.S. Env. Protection Agency, Cincinnati, OH, (March 8-10, 1982).

Thibodeaux, L. J., "Transport of Pesticides and Related Chemicals Across Air-Water Interfaces" Prediction of Pesticide Behavior in the Environment, Proceedings of USA-USSR Symposium, October 1981, Yerevan, USSR (Published Simultaneous in Russia in hardback).

Thibodeaux, L. J., D. G. Parker, H. Heck. and R. Dickerson, "Quantifying Organic Emission Rate from Surface Impoundments with Micrometeorlogical and Concentrations Profile Measurements," Paper No. 127e, AIChE microfiche preprint in the Engineering Societies Library, United Engineering Center, 345 East 47th Street, New York, New Orleans Ann. Mtg., (Nov, 8-12, 1981).

Proceedings (Manuscripts Published): (continued)

Thibodeaux, L. J., R. Merill and D. Wolbach, "Pentachlorophenol and Naphthalene Emissions to Air During Therman Evaporation of Wastewater," paper No. 1196 AIChE microfiche preprint in the Engineering Societies Library, United Engineering Center, 345 East 47th Street, New York, New Orleans Ann. Mtg., (Nov, 8-12, 1981).

Springer, C. S., and L. J. Thibodeaux, "Mechanisms and Models for Predicting the Desorption of Volatile Chemicals from Wastewater," Proceedings 7th Annual Symposium, U.S. Env. Protection Agency, MERL, Cincinnati, OH, (March 1981), p. 85-90.

Thibodeaux, L. J., D. Moncada, "Performance Comparison of A Crossflow Cascade and A conventional Countercurrent Operation in Packed Towers," Paper 21st AIChE microfiche preprint in the Engineering Societies Library, United Engineering Center, 345 East 47th Street, New York, Chicago Ann. Mtg., (Nov. 16-20, 1980).

Thibodeaux, L. J., P. S. Christy, "The Spill of Sinker Chemicals - Laboratory Simulations," Proceedings of the 1980 Conference on Control of Hazardous Materials Spills, (May 13-15, 1980), Louisville, KY p. 369-374.

Thibodeaux, L. J., D. G. Parker, "Emission of Volatile Chemicals from Wastewater Plants," Special Report, National Council Air Stream Improvement, for Proceedings 1979 So. Regional Mtg., (June 6,7, 1979), New Orleans, LA.

Thibodeaux, L. J., L. K. Chang, J. K. Harris, D. J. Lewis and M. W. Mourot, "Laboratory Results on the Spill of Soluble, High Density Chemicals on Water," Proceedings 4th Joint Conference on Sensing Environmental Pollutants, Washington, D.C. (1978), p. 511-514.

Thibodeaux, L. J., and D. G. Parker, "Desorption Limits of Selected Gases and Liquids from Aerated Basins," AIChE Symp. Series 156, Vol. 72, 1976.

Thibodeaux, L. J., "Air-Stripping of Organics from Wastewater: A Compendium," AIChE Proceedings of 2nd National Conference on Complete Water Reuse, May 5-8, 1975, Chicago, IL, p. 358.

Thibodeaux, L. J., and N. J. Carter, "Coliform Emissions from Air/Water contractors: A Preliminary Attempt to Establish Maximum Concentrations," AIChE Symp. Series 137, Vol. 70, 1974.

Thibodeaux, L. J., B. Kirsch and D. T. Mitchell, "Methodology of a Regional Industrial Waste-water Audit," presented at 28th Annual Purdue Industrial Waste Conference, West Lafayette, IN, May 1-3, 1973.

Thibodeaux, L. J., R. B. Estridge and B. G. Turner, "Simultaneous Stripping, Biochemical Oxidation and Cooling of Kraft Mill Wastewater," AIChE Symposium Series--Forest Products and the Environment, No. 133, Vol. 69, 1973.

Prodeedings (Manuscripts Published): (continued)

Thibodeaux, L. J., "Measurement of the Relative Volatilization Rates of the Water-Miscible Fractions in an Aqueous Effluent," AIChE Symposium Series (WATER-1971) 68, 124, p. 169 (1972).

Thibodeaux, L. J., D. R. Smith and H. R. Berger, "Water Renovation Possibilities in the Pulp and Paper Industry," Chemical Engineering Progress Symposium Series 90 (AIChE), Vol. 64, 1968, pp. 178-186.

REPORTS AND BULLETINS

Thibodeaux, L.J., "Offensive Environmental Chemical Engineering", The Inaugral Lecture on the occasion of appointment as Professor of Chemical Engineering, L.S.U., Baton Rouge, LA, December 6, 1985 (11p).

Springer, C., K.T. Valsaraj, and L.J. Thibodeaux, "In-situ Mehtods to Control Emissions from Surface Impoundments and Landfills", Final Report, Project CR810856-01-1, U.S.EPA Hazardous Waste Engineering Research Lab., Cinn., OH, 1985.

Springer, C., P.D. Lunney, K.T. Valsaraj, and L.J. Thibodeaux, "Emission of Hazardous Chemicals from Surface and Near Surface Impoundments to Air, Final Report, Project No. 808161-02, U.S.EPA, Solids and Hazardous Waste Research Division, Cinn., OH, December 1986.

Dean, J.D., D.F. Atwood, A.S. Dorigan, F.R. Groves, L.J. Thibodeaux, P.S.C. Rao and J.R. Withey, "Exposure Assessment involving Mixtures of Environmental Pollutant" Final Report to the U.S.EPA on Contract #68-03-3116.

Thibodeaux, L. J., and D. Wolf, "Impact of High Chemical Contaminant Concentrations on Terrestrial and Aquatic Exosystems: A State-of-the-Art Review," USEPA, Athens Environmental Research Lab., Athens, GA (1983).

Thibodeaux, L. J., C. Springer and P. D. Lunney, "Emission of Hazardous Chemicals from Surface Impoundments to Air," USEPA, Municipal Environmental Research Laboratory, June 1983 (in review).

Thibodeaux, L. J., D. G. Parker, and H. Heck, "Measurement of Volatile Chemical Emissions from Wastewater Basins," Final Report, U.S. Environmental Protection Agency, IREL, Cincinnati, OH, January, 1982, 79p.

Thibodeaux, L. J., "Spill of Soluble, High-Density, Immiscible Chemicals in Water," DOT/RSPA/DPB-50/78/25, U.S. Department of Transportation, Office of University Research, Washington, DC, (1978).

Thibodeaux, L. J., "The Quantity of High Volatile Constituents in Industrial Wastewater," Final Technical Letter Report for National Science Foundation, NSF-ENG 74-17316, Washington, D.C., July 1977, 6p.

Reports and Bulletins: (continued)

Thibodeaux, L. J., "An Aqueous Environmental Simulation Model for Mid-South Lakes and Reservoirs," Water Resources Research Center Pub. No. 41, University of Arkansas, Fayetteville, Arkansas (1976).

Thibodeaux, L. J., "A Test Method of Volatile Component Stripping of Wastewater," Report EPA-660/2-74-044, U.S. Environmental Protection Agency, Washington, DC, (1974).

Thibodeaux, L. J., "Industrial Wastewater Survey-Northwest Arkansas Water Quality Management Sgudy," Report No. NWARPC/UA-1, Northwest Arkansas Reg. Plan. Comm. Springdale, AR (1972).

Thibodeaux, L. J., "Preliminary Report on National Rejectors Industrial Wastewater Treatment Facilities and Practices," National Rejectors Inc., Hot Springs, Arkansas (August 1971).

Thibodeaux, L. J., "Natchez Mill Wastwater Improvement Studies," Final Report, International Paper Company, Natchez, Mississippi (September 1970).

Thibodeaux, L. J., and R. L. Wright, "Deionization of Paper Industry Wastewater by Ion Exchange," Special Report, Nat. Council Air Stream Imp., 103 park Ave., New York, New York (May 1970).

Thibodeaux, L. J., and H. F. Berger, "Laboratory and Pilot Plant Studies on Water Reclamation," Tech. Bul. No. 203, Nat. Council Air Stream Imp., 103 Park Ave., New York, NY (July 1967).

Thibodeaux, L. J., "Improvement Study of Scotts Bluff Plant Effluent," Final Report, Naugatuck Chemical Co., Baton Rouge, LA, (August 1964).

TECHNICAL PRESENTATIONS

Thibodeaux, L. J., "Physical and Chemical Methods of Kraft Mill Wastewater Treatment," Seminar given to Department of Bio-Environmental Engineering, University of Florida, Gainesville, FL, August 1967.

Thibodeaux, L. J., "Water Pollution Prevention and Treatment," Interdisciplinary Toxicology Seminar, University of Arkansas Animal Science Center, Fayetteville, Arkansas, June 1969.

Thibodeaux, L. J., "Use of Chemical Engineering Design Procedures in Wastewater Treatment," Georgia WPCA Annual Conference, Savannah, Georgia, Sept. 20-23, 1970.

Thibodeaux, L. J., R. B. Estridge and B. G. Turner, "Measurement of the Relative Volatilization Rates of the Water-Miscible Fractions in an Aqueous Effluent," 69th National AIChE Meeting, Cincinnati, OH, May 16-19, 1971.

Thibodeaux, L. J., R. B. Estridge and B. G. Turner, "Simultaneous Biochemical Oxidation, Stripping and Cooling of Kraft Mill Wastewater," 73rd National AIChE Meeting, Minneapolis, MN, August 1972.

Technical Presentations: (continued)

Thibodeaux, L. J., "Review of Biotreating Processes for Wastewaters," 26th Annual Meeting, Bartlesville Section AIChE, Bartlesville, OK, March 25, 1972.

Thibodeaux, L. J., and N. J. Carter, "Coliform Emissions from Air/Water Contactors: A Preliminary Attempt to Establish Maximum Concentrations," AIChE Meeting, New York, NY, Fall 1972.

Thibodeaux, L. J., B. Kirsch, and D. Mitchell, "Methodology of a Regional Wastewater Audit," 28th Annual Purdue Industrial Waste Conference, West Lafayette, Indiana, May 1-3, 1973.

Thibodeaux, L. J., and D. G. Parker, "Desorption Limits of Selected Industrial Gases and Liquids from Aerated Basins," 76th National AIChE Meeting, Tulsa, OK, March 10-13, 1974.

Thibodeaux, L. J., and J. R. Jones, "A Test method for Volatile Component Stripping of Wastewater," National AIchE Meeting, Salt Lake City, UT, Fall 1974.

Thibodeaux, L. J., "Air-Stripping of Organics from Wastewater-A Compendium," 2nd National Conference on Water Reuse, Chicago, IL, May 5-8, 1975.

Thibodeaux, L. J., "Interphase Transport in the Natural Environment," AIChE Mid-Michigan Section, Midland Michigan, February 18, 1976.

Thibodeaux, L. J., and J. D. Millican, "Quantity and Relative Desorption Rates of the Air-Strippable Organics in Industrial Wastewater," ACS 172nd Meeting, San Francisco, California, August 29-September 3, 1976.

Spill of Sinker Chemicals in Flowing Water, March 12, 1977, Oklahoma Amer. Inst. Chemical Engr., Bartlesville, OK.

Mechanisms and Idealized Dissolution Modes for High Density (p 1), Immiscible Chemicals Spilled in Flowing Water, March 23, 1977, 83rd National AIChE, Houston, TX.

Laboratory Results on the Spill of Soluble, High Density Chemicals in Water, Nov. 6-11, 1977, 4th Joint Conf. Sensing Environmental Pollution, New Orleans, TN.

Laboratory Observation of the Spill of Heavy Liquids (p 1) in Water Dec. 5-7, 1977, 33rd S.W. Amer. Chem. Soc., Little Rock, AR.

Fluid Dynamics of a Packed, Crossflow Cascade at High Loadings, February 26-March 1, 1978, 84th National AIChE, Atlanta, GA.

Fluid Dynamics and Oxygen Desorption Rates in a Crossflow Packed Column, March 22, 1978, Arkansas Section AIChE, Little Rock, AR.

Technical Presentations: (continued)

Spill of Soluble, High Density Immiscible Chemicals on Water, June 6, 1978, Department of Transportation, U.S. Coast Guard, Washington, D.C.

Measurement of the Oxygen Desportion Rate in a Single Stage Crossflow Pakced Tower, September 10-15, 1978, Amer. Chem. Soc., Miami, FL.

Dissolution Rates of Organic Contaminants Located at the Sediment Interface Rivers, Streams, and Tidal Zones, April 6-13, 1979, Amer. Chem. Soc., Honolulu, HI.

Review of Crossflow Mass-Transfer, may 10, 1979, Norton Chemical Co., Cleveland, OH.

Dissolution Processes in an Unstratified Lake, May 14-15, 1979, Amer. Water Resources Association, Arkadelphia, AR.

Emission of Volatile Organic Carbon and Reduced Suflur Compounds from Wastewater Treatment Plants, June 6-7, 1979, National Council Air Stream Improvement So. Reg. Mtg., New Orleans, LA.

Sediment/Chemical Dissolution Processes in an Unstratified Lake, Sept. 17, 1979, UA ChE, Fayetteville, AR.

Measurement of Volatile Chemical Emissions from Wastewater Basins Oct. 29-30, 1979, U.S. Environmental Protection Agency, Industrial Research Environmental Lab., Cincinnati, OH.

Estimating the Air Emissions of Chemicals from Hazardous Waste Landfills, November 25-29, 1979, Annual Mtg. AIChE, San Francisco, CA.

A Review of Crossflow Mass-Transfer, February 29, 1980, Department of Chemical Engineering, University-Missouri, Rolla, MO.

The Spill of Sinker Chemicals-Laboratory Simulations, May 13-15, 1980 Hazardous Spills Conference, Louisville, KY.

An Aerodynamic - Hydrodynamic Interaction Model of the Bottom Water Mass-Transfer Coefficient in Lakes and Similar Waterbodies, Aug. 24-29, 1980, Amer. Chem. Soc., Las Vegas, NV.

Chemodynamics - What we know and what we don't know, Sept, 22, 1980 UA ChE, Fayetteville, AR.

Spill of Soluble, High Density Immiscible Chemicals on Water, Oct. 2, 1980, Department of Transportation, U.S. Coast Guard, Washington, D.C.

Performance Comparison of A Crossflow Cascade and a Conventional Countercurrent Operation In Packed Towers, Nov. 16-20, 1980, Annual Mtg., AIChE, Chicago, IL (Delivered by D. Moncada)).

Technical Presentations: (continued)

Quantifying Organic Emission Rates from Surface Impoundments with Micrometeorlogical and Concentration Profile Measurements, Jan. 7, 1981, U.S. Environmental Protection Agency, RTP, Durham, NC.

Chemodynamics - What we know and what we don't know, March 5, 1981 Dept. of Chemical Engineering, OK State University, Stillwater, OK.

Models of Mechanisms for Hazardous Chemical Emissions from Landfills, March 29-April 3, 1981, Amer. Chem. Soc., Atlanta, GA.

Chemodynamics - What we know and what we don't know, April 29, 1981, Rensleaar Poly. Institute, Troy, NY

Chemodynamics - What we know and what we don't know, May 19, 1982, Dow Chemical, Freeport, TX

Chemodynamics - What we know and what we don't know, June 10, 1981, Department of Chemical Engineering, Tech. High School, Zurich, Switzerland.

Gas-Side Mass-Transfer Coefficient and Interfacial Phenomena of Flat-Bladed Surface Agitators, Oct. 4-9, 1981, Second World Congress Chem. Engr. Montreal Canada (delivered by James Reinhardt).

Gas Crossflow Distillation in Packed Towers, Oct. 4-9, 1981, Second World Congress Chem. Engr., Montreal, Canada (delivered by Bruce Eldridge).

Transport of Pesticides and Related Chemicals Across Air-Water Interfaces, Oct. 17-31, 1981 US-USSR Symposium on Transport of Pesticides in the Environment, Yerevan, Armenia SSR.

Spill of Soluble, High Density, Immiscible Chemicals in Rivers, Nov. 8-11, 1981, Ann. Mtg. AIChE, New Orleans (delivered by Pattie S. Christy).

Pentachlorophenol and Naphthalene Emissions to Air During Thermal Evaporation of Wastewater, Nov. 8-11, 1981, Ann. Mtg. AIChE, New Orleans, LA.

A Model for Volatile Chemical Emissions to Air from Landfarming of Oily Waste, Nov. 8-11, 1981, Ann. Mtg. AIChE, New Orleans, LA.

Quantifying Organic Emission Rate from Surface Impoundment with Micrometeorological and Concentration Profile Measurements, Nov. 8-11, 1981, Ann. Mtg., AIChE, New Orleans, LA.

A Simulation Study of the Volatilization of Polychlorinated Biphenyls from Landfill Disposal Sites, October 4-8, 1981, 4th Annual Oak Ridge National Laboratory Life Sciences Symposium on Environment and Solid Waste, Oak Ridge, TN (delivered by C. Springer).

Technical Presentations: (continued)

Mechanisms and Models for Predicting the Desorption of Volatile Chemicals from Wastewater, 7th Annual Research Symposium, U.S. Envir. Protection Agency, March 16-18, 1981, Philadelphia, PA (delivered by C. Springer).

Chemical Volatilization Mechanisms from Surface Impoundments in the Absence of Wind, March 8-10, 1982, 8th Annual Research Symposium U.S. Environmental Protection Agency, Cincinnati, OH.

Measurement of Volatile Chemical Emissions from Aerated Stabilization Basins, National Conference on Environmental Engineering, Env. Engr. Div. ASCE, Atlanta, GA, July 1981 (presented by H. Heck).

Thibodeaux, L. J., and C. Springer, presented "Identification of Volatilization Mechanisms" at EPA Research Symposium in Cincinnati, OH, (Feb., 1982)

Thibodeaux, L. J., "Off-site Transport of 2,3,7,8-Tetrachlorodibenzo-p-dioxin from a Production Disposal Facility" was presented at the American Chemical Society Meeting at Kansas City, (Sept. 1982).

Thibodeaux, L. J., and C. Springer, "Air Emission Monitoring of Hazardous Wastes Sites" at National Conference on Management of Uncontrolled Hazardous Wastes Sites, Washington, D.C. (Nov. 1982).

Thibodeaux, L. J., "Chemodynamics at Environmental Interfaces-the Mass Transport Aspects," Monsanto Company Technical Community, St. Louis, MO, Nov. 8, 1982.

Thibodeaux, L. J., "Chemicals in the Environmental," University de Santiago, Santiago de Compostela, Spain, April 19, 1983.

Thibodeaux, L. J., "Hazardous Chemicals in the Environment: Mass Transfer Aspects," University of Exeter, Exeter, England, April 29, 1983.

Thibodeaux, L. J., "Chemical Engineering Research in Hazardous Waste," 7th Anniversary Symp. Arkansas Chemical Industry, Little Rock, AR, Oct. 27-28, 1983.

Thibodeaux, L. J. and C. Springer, "Monitoring and Modelling of Chemical Vapor Emissions from Industrial Hazardous Waste Sites," Third International Symposium on Industrial and Hazardous Waste, June 24-27, 1985, Alexandria, Eqypt.

Groves, F. R., D. D. Reible and L. J. Thibodeaux, "Estimation of Physical and Chemical Properties of Waste Organic Mixtures Associated with Land Pollution," American Chemical Society, Miami, FL, April, 1985.

Technical Presentations: (continued)

Boyle, J. D., T. Sheppard, R. J. Case, A. Koulermos and L. J. Thibodeaux, "Transfer of Solutes between Water Flowing Above and Through Permeable Riverbeds," American Chemical Society, Miami, FL, April, 1985.

Thibodeaux, L.J., "Volatile Emissions from Toxic and Hazardous Waste", Institute for Environmental Studies, University of Toronto, Toranto, Canada, January 17, 1985.

Thibodeaux, L.J., "The Chemodynamics of Hazardous Chemicals in the Natural Environment-Mass Transport Aspects", Deptartment Chemical Engineering, University of Toranto, Toranto, Canada, January 17, 1985.

Thibodeaux, L.J., "Estimating and Controlling VOC Emissions from Land Disposal and Treatment Operations", Environmental Design Symposium, Baton Rouge Section, American Institute Chemical Engineers, B.R., November 20, 1985.

Thibodeaux, L.J., "Sources and Initiating Mechanisms for Chemical Contamination of Groundwater", Seminar-Ground Water Contamination in Louisiana - Issues and Answers, Baton Rouge, February 27, 1986.

Thibodeaux, L.J., "Volatile Chemical Emissions from Toxic and Hazardous Waste in Land Disposal and Treatment Operations - A Review of Selected Literature", Second Annual Conference Current Topics in Hazardous Waste Control, Georgia Tech. Research Institute, Atlanta, Februay 6-8, 1985.

Thibodeaux, L.J., "Volatile Orgainc Chemicals from Land Disposal of Waste - Mechanism Emissions and Control Strategies", Feature Paper III, Technology Transfer Conference No. 6, Ministry of Environment, Ontario, Toronto, CA, December 11-12, 1985.

Thibodeaux, L.J., "Chemodynamics in the Natural Environment: The Mass-Transport of Chemicals at the Sediment/Water Interface", U.S.EPA, Athens Environmental Research Laboratory, Athens, GA, January 9, 1986.

Thibodeaux, L.J., "Chemodynamics in the Natural Environment: Mass-Transport of Chemicals at the Sediment/Water Interface", University of Akron, Akron, OH, February 14, 1985.

Thibodeaux, L.J., "Treatment of Hazardous Waste from Chemical Plants and Refineries", Chemical Processing Table Top Show and Seminar, Baton Rouge, LA, September 25, 1985.

Savant, S.A., D.D. Reible and L.J. Thibodeaux, "Modeling Convective Transport in River Sediments," to be presented at the National Meeting of the American Chemical Society, Anaheim, CA, September, 1986.

Technical Presentations: (continued)

Groves, F.R., D.D. Reible and L.J. Thibodeaux, "Estimation of Physical and Chemical Properties of Waste Organic Mixtures Associated with Land Pollution", presented at the National Meeting of the ACS, Miami, FL, May, 1985.

SPONSORED RESEARCH PROJECTS

Title: Northwest Arkansas Water Quality Management Study-Industrial Wastewater Survey
Agency: U.S. EPA
Period of Support: 1970-72
Total Dollars: $30,000

Title: A Test Method of Volatile Component Stripping of Wastewater in Cooling Towers
Agency: U.S. EPA
Period of Support: 1972-73
Annual Dollars: $38,538
Total Dollars: $38,538

Title: The Quantity of Highly Volatile Constituents in Industrial Wastewaters
Agency: National Science Foundation
Period of Support: 1975-76
Annual Dollars: $24,185
Total Dollars: $24,185

Title: An Aqueous Environmental Simulation Model for Mid-South Lakes and Reservoirs
Agency: U.S. Dept. Interior
Period of Support: 1973-76
Annual Dollars: $7,079
Total Dollars: $21,237

Title: Spill of Soluble High Density, Immiscible Chemicals on Water
Agency: USCG, DOT
Period of Support and Annual Dollars: 1977 - $48,520
1978 - $46,654, 1979 - $10,642
Total Dollars: $105,816

Title: Measurement of Volatile Chemical Emissions from Wastewater Basins
Agency: U.S. EPA
Period of Support: 1977, 1978, 1979, (extension)
Total Dollars: $127,782

Title: Emission of Hazardous Chemicals from Surface and Near Surface Impoundments into Air
Agency: U.S. EPA
Period of Support and Annual Dollars: 1980-81 $156,872
1981-82 $148,457, 1982-83 $154,238
Total Dollars: $459,567

Sponsored Research Projects: (continued)

Title: Impact of High Chemical Contaminant Concentrations on Terrestrial and Aquatic Ecosystems: A State-of-the-Art Review"
Agency: U.S. EPA
Period of Support and Annual Dollars: 1982-83 $16,381

Title: Investigation of Volatile Organic Chemical Emission Control Methods from Hazardous Waste Disposal Operations
Agency: U.S. EPA
Period of Support: 1983-1985
Total Dollars: $262,888

Title: An Experimental Study of the Short Range Air Dispersion of Toxics from Area Sources"
Agency: U.S. EPA Office of Exposure Assessment
Period of Support: 1986
Total Dollars: $75,000

Title: Single Cell and Cascade Crossflow Packed Towers for Air-Stripping of Volatile Organics
Agency: U.S. Air Force
Period of Support: April 1986 - October 1987
Total Dollars: $164,947

AWARDS, HONORS

1974 Awarded off-campus-duty-assignment to Oregon State University
1977-78 Elected President Sigma Xi, UA Chapter
1979-80 Dr. Yoshishi Hayashi, Visiting Professor, Kanazawa, Japan to UA research on crossflow mass transfer
1982 College of Engineering, Outstanding Research in Chemical Engineering ($1000)
1982 University of Arkansas Alumni Award, Outstanding Researcher and Teacher ($1000)
1982 Halliburton Company Award for Excellence in Research
1983 Awarded off-campus-duty-assignment to University of Exeter, Exeter, England
1983 Dr. Hans Schecker, Visiting Professor, University of Dartmund, W. Germany, to UA, study environmental chemical engineering research activities

ADVISORY COMMITTEES, PANELS, DELEGATIONS

State of Arkansas Hazardous Waste Technical Advisory Committee, member appointed by W. Clinton, Governor (Dec. 1979 to Dec. 1981)

AIChE, ad hoc committee, National Academy of Sciences/EPA Study on Disposal of Hazardous Industrial Waste-member of funds solicitation committee (March-October, 1980).

U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, GA - reviewer for Technology Development Applications Branch, Pesticide Exposure Assessment Technology, February 19, 1983.

Advisory Committees, Panels, Delegations: (continued)

Panel discussion member: Major Technical Issues Relating to the Land Disposal of Hazardous Waste, Arlington, VA, may 18-22, 1981.

Delegation member: USA-USSR Symposium: "Prediction of Pesticide Behavior in the Environment," Yerevan, Armenia SSR, Oct. 18-31, 1981.

Member, workshop: Determining the Field Applicability of Environmental Assessment Methods, U.S.EPA, Washington, DC, March 15-19, 1982.

Member, EPA level I and II Exposure Assessment Workshop, Washington, DC, April 6-7, 1982 and Atlanta, GA, April 27-29, 1982.

Member Scientific Advisory Committee of Hazardous Waste Research Center, Louisiana State University, Baton Rouge, LA 1982-83.

Peer Review Panel: Dioxin Documents to Assess the Health Risk in Air and Water Media, U.S. EPA, Cincinnati, OH, July 27-29, 1983.

Peer Review Panel: E.P.A. Office of Exploratory Research Chemistry/Physic, Chicago, ILL, October 25-27, 1985.

Member of Sate of Louisiana, Department of Environmental Quality Hazardous Waste Advisory Board (Appointed by Governor) 1985-1990.

YOAKUM, ANNA M.

Professional Qualifications:

Has spent entire career in analytical chemistry. Completing current three-year special assignment as Analytical Program Manager for Train Derailment Project, Livingston, Lousisiana, for Illinois Gulf Central Railroad, responsible for all field and in-house sampling and analytical to determine extent of contamination, prepare closure plan, and monitor compliance with closure plan, including product recovery system. Personal specialization has been in research and method development. Since 1960, has worked in atomic absorption and flame emission spectrophotometry; ultraviolet, visible and infrared absorption spectrometry; fluorescence spectrophotometry; gas chromatography; HPLC; emission spectroscopy; and gas chromatography/mass spectrometry. Has dealt extensively with a variety of concentration techniques applicable to "ultra" trace metals analysis (10 parts per billion and less), including chelations, extraction, ion exchange, electrodialysis, and selective volatilization. Was co-founder and Laboratory Director of Stewart Laboratories, Inc. an independent analytical testing laboratory founded in 1968 and acquired by the IT Corporation in 1981. Designed and directed extensive research and method development programs in area of organic and inorganic analytical methodology relating to environmental assessment--especially those dealing with water, effluents, biological tissues, environmental samples, hazardous waste, and air particulates. Had management responsibility for the development of a company Quality Assurance Program. Wrote quality assurance manual and was instrumental in implementation of the over-all QA/QC plan. Has directed over 15,000 analytical projects in the past seventeen years. Has served as Project Director for over twenty government contracts.

Education:

B.S., Maryville College, Maryville, Tennessee, 1954.
M. S., University of Florida, Gainesville, Florida, 1956.
Ph.D., University of Florida, Gainesville, Florida, 1960

Employment History:

1983 to Present	IT Analytical Services, Knoxville, Tennessee. Technical Director. Overall responsibility for technical direction of IT Corporation's Analytical Services, a nationwide network of analytical testing facilities providing services to industry, government, and inter-company activities. Analytical program manager for Livingston, Louisiana train derailment project.
1981 to 1983	IT Analytical Services, Knoxville, Tennessee. Laboratory Director. Overall management and technical responsibility for the Stewart Laboratories Division of ITAS.

YOAKUM, ANNA M.

1968 to 1981 — Stewart Laboratories, Inc., Knoxville, Tennessee. Executive Vice President and Laboratory Director. Supervised overall laboratory activities, both technical and operational. Designed and directed extensive research and method development programs for environmental chemical analysis. Has directed over 15,000 analytical projects since 1968. Has served as Project Director for over twenty government contracts.

1964 to 1968 — Oak Ridge National Laboratory, Oak Ridge, Tennessee. Senior Research Staff, Analytical Chemistry Division. Method development research in emission spectroscopy and atomic absorption spectrophotometry.

1960 to 1964 — Chemstrand Research Center. Research Chemist, Analytical and Basic Research Divisions. Research and method development in emission, flame, x-ray fluorescence and infrared spectroscopy.

1959 to 1960 — University of Florida, Gainesville, Florida. Graduate School Fellow.

1956 to 1959 — Greenback Industries, Inc. Supervisor, Control Laboratory. Method development in wet chemistry and emission spectroscopy.

1955 to 1956 — University of Florida. AEC Research Assistant.

Publications:

Masters Thesis: A Study of Quaternary Ammonium Anion Exchange Resins with Respect to Equilibrium Hydration and Certain Preferential Capacities. University of Florida, June 1956.

Ph.D. Dissertation: Emission Spectrochemical Determination of Residual Trace Elements in Sponge Copper Powders. University of Florida, August 1960.

"Recent Advances in Analytical Emission Spectroscopy," Developments in Applied Spectroscopy, Vol. 6, Editors: W. K. Baer, A. J. Perkins, and E. L. Grove, Plenum Press, New York (1968), pp. 57-66.

"Recent Advances in Analytical Emission Spectroscopy," Applied Spectroscopy Reviews, Vol. 3, No. 1, 1969, pp. 1-45.

"A Review of Recent Achievements in Analytical Emission Spectroscopy," Developments in Applied Spectroscopy, Vol. 8, Editor: E. L. Grove, Plenum Press, New York (1970).

"Method Development and Subsequent Survey Analysis of Biological Tissues for Platinum, Lead, and Manganese Content," Environmental Health Perspectives, April, 1975.

YOAKUM, ANNA M. (Continued)

"Determination of Human Body Burden Baseline Data of Platinum through Autopsy Tissue Analysis," Environmental Health Perspectives, Vol. 15, June 1976.

"Analysis of Blood, Hair, Urine, and Dust Samples for Heavy Metals," EPA Report No. EPA-600/1-76-029, September 1976.

RESEARCH PRESENTATIONS

"The Spectrochemical Determination of Bismuth and Rare Earths in Molten Salt Reactor Fuel," Thirteenth Conference on Analytical Chemistry in Nuclear Technology, Gatlinburg, Tennessee, October 2, 1969.

"Applications of Ion-Selective Electrodialysis to the Spectrochemical Determination of Silicon in Curium Oxide," Pacific Conference on Chemistry and Spectroscopy, Anaheim, California, October 6-10, 1969.

"How to Sample A River," Sampling, Standards, and Homogeniety, ASTM 75th Annual Meeting and Exposition, Los Angeles, California, 1972.

"Determination of Platinum, Lead, and Manganese in Biological Tissues by Emission Spectroscopy," 1974 Pacific Conference on Chemistry and Spectroscopy, San Francisco, California, October 16-18, 1974.

"A General Electronic Data Processing Technique for Atomic Absorption Spectroscopy," 3rd Annual Meeting FACSS, Philadelphia, Pennsylvania, November 1976.

"Screening Techniques for Toxic Pollutants," 1979 General Electric Environmental Seminar, Orlando, Florida, April 5, 1979.

"The Role of Atomic Absorption Spectrometry in the Analysis of Biological Fluids for Trace Metals," FACSS-VI, Philadelphia, Pennsylvania, September 18, 1979.

SOCIETY AFFILIATIONS

American Chemical Society
American Council of Independent Laboratories
Analytical Chemistry Division--ACS
Society for Applied Spectroscopy
American Society for Testing and Materials
New York Academy of Sciences
Fellow, American Institute of Chemists
The Coblentz Society
Gamma Sigma Epsilon

YOAKUM, ANNA M. (Continued)

HONORS

Phi Beta Kappa
Phi Kappa Phi
Sigma Xi
Who's Who of American Women
Who's Who in the South and Southwest
American Men and Women of Science
The World Who's Who of Women
Dictionary of International Biography
Recipient of Alumni Citation for Outstanding Service to Mankind --
Maryville College, June 2, 1979

ANNA M. YOAKUM
PCB Related Experience
Supplement to Resume

Dr. Yoakum was actively involved in all aspects of environmental sampling and analysis of PCBs from 1970 until her retirement in 1986. This involvement included the interpretation of data and preparation of reports for the analysis of PCB mixtures in complex waste samples and environmental matrices using GC and GC/ MS analytical methods development and the design of special studies including a collaborative testing program for the General Electric Company. She is presently serving as a technical consultant for a PCB contamination assessment of 375,000 sq. ft. building following a transformer fire. PCB related experience and specific projects include:

1. Environmental Evaluations
2. Potential Litigation Support
3. PCB Incinerator Trial Burns
4. Analytical Support of Site Remediation Projects
5. Sampling and Analysis for Spill Response
6. Environmental Montoring for NPDES Discharge Compliance
7. Building Contamination Assessments Involving PCB Transformer Fires

Edgar W. Garbisch
Environmental Concern Inc.
P.O. Box P
St. Michaels, MD 21663
(301) 745-9620

EDUCATION:

1955 B.S., Chemistry, University of North Carolina, Chapel Hill, NC
1961 Ph.D., Chemistry, Northwestern University, Evanston, IL

EXPERIENCE PROFILE:

Wetlands restoration and establishment

Wetlands mitigation design and specifications

Landscaping approaches to erosion control

Nursery production of herbaceous and woody wetland plants and wildflowers

Large scale wildflower meadow development

EMPLOYMENT:

1972-Present, Founder and President, Environmental Concern Inc.
Providing a full range of consulting and landscaping services for wetland improvements, restorations, developments, and mitigations; and for habitat development for waterfowl, gamebirds, and songbirds; and low maintenance landscaping. The firm pioneered and pursues the use of landscaping techniques for shore erosion control.

1971, Director, Center for Applied Research in Environmental Sciences of the Nature Conservancy, St. Michaels, MD
Developed some of the technology for wetlands establishment and completed the first successful large scale (4 acres) wetland establishment project

1964-1971, Assistant Professor, Associate Professor (1965), Full Professor (1969), Chemistry, University of Minnesota

1962-1964, Assistant Professor, Chemistry, University of Chicago

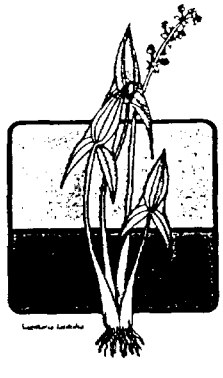
1961-1962, National Science Foundation Postdoctoral Fellow

ASSOCIATIONS:

Society of Wetland Scientists
The Ecological Society of America
American Chemical Society

OTHER ACTIVITIES:

53 Publications, 13 related to wetlands
Received the 1980 Special Category Award presented by the Maryland Chapter of the American Society of Landscape Architects
Received the 1982 Award as Outstanding Conservationist in Wetland Restoration by the Soil Conservation Society of America
Received the 1983 Commendation from the U.S. Army Corps of Engineers for the development of wetland and wildlife habitat on a 50 acre dredged material island in the Chesapeake Bay
Provided 41 invited lectures at colleges, universities, conferences, and symposiums



B

FEBRUARY 1989 COMMUNITY WORK GROUP HANDOUT

NEW BEDFORD HARBOR
COMMUNITY WORK GROUP PRESENTATION
FEBRUARY 16, 1989

PRESENTATION OUTLINE

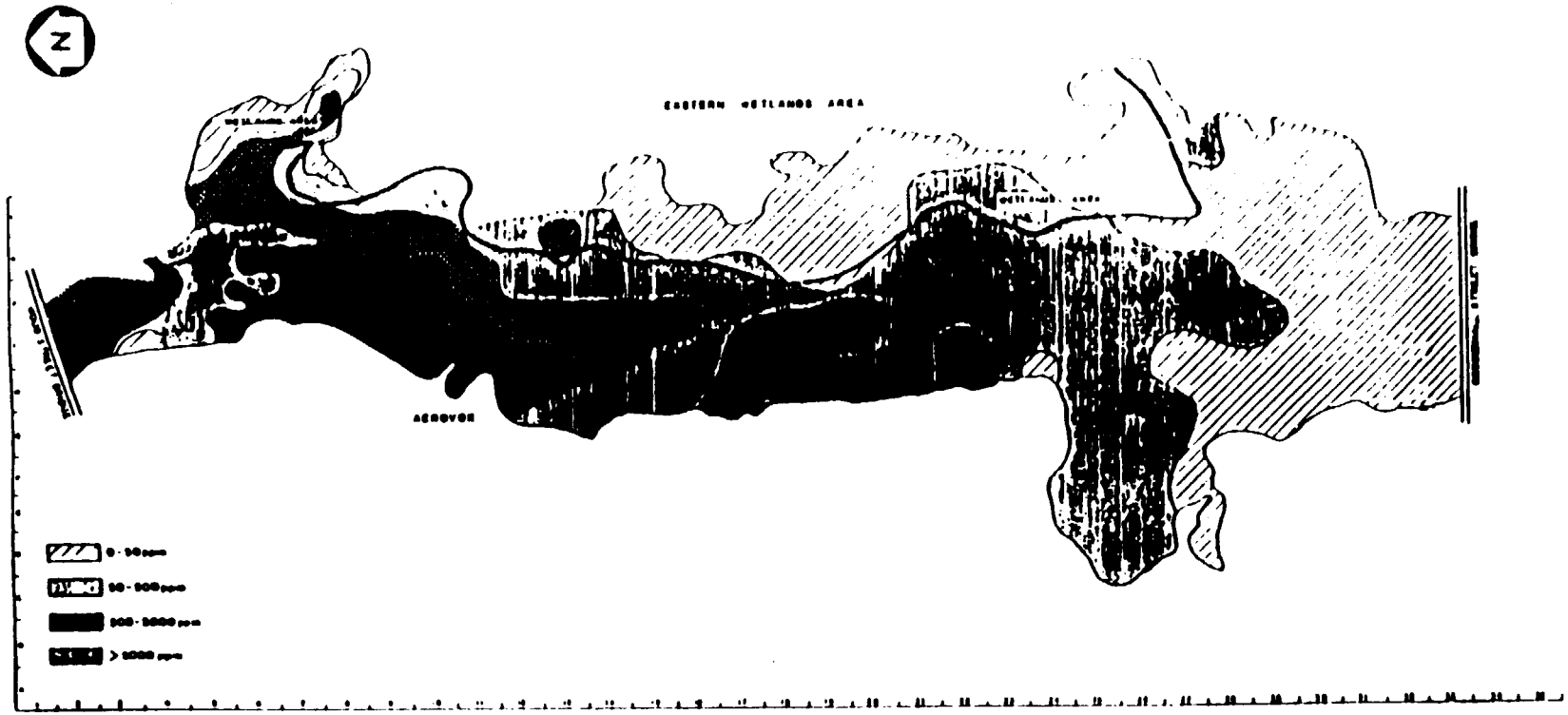
- OVERVIEW OF ESTUARY AREA
- OVERVIEW OF ESTUARY FEASIBILITY STUDY
- HIGHLIGHT ENGINEERING AND COST FOR ESTUARY ALTERNATIVES
  - Est-2 DREDGE/DISPOSE
  - Est-2d DREDGE/DEWATER/DISPOSE
  - Est-3 DREDGE/DEWATER/SOLIDIFY/DISPOSE
  - Est-4 DREDGE/DEWATER/SOLVENT EXTRACT/DISPOSE
  - Est-5 DREDGE/DEWATER/INCINERATE/SOLIDIFY/DISPOSE

NEW BEDFORD HARBOR
COMMUNITY WORK GROUP PRESENTATION
FEBRUARY 16, 1989

OVERVIEW OF ESTUARY AREA

- LOCATED BETWEEN WOOD STREET AND COGGESHALL STREET BRIDGES
- PCB CONTAMINATION RANGES FROM 4000 ppm TO NON-DETECTABLE LEVELS

Target Level	Cleanup Volume
>500 ppm	120,370 cy
> 50 ppm	351,851 cy
> 10 ppm	527,777 cy
> 1 ppm	668,981 cy
> DL	1,233,795 cy

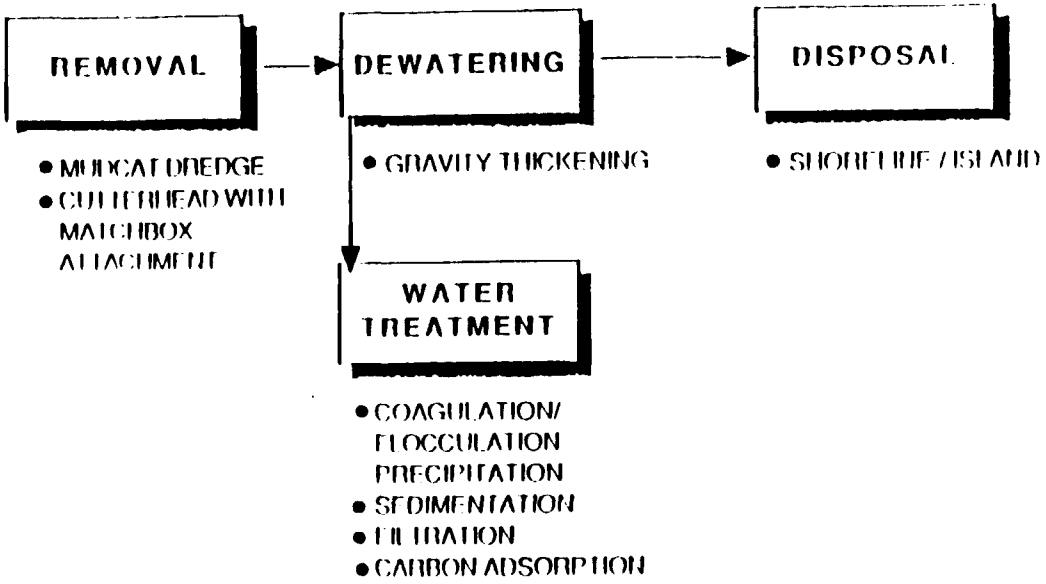


NEW BEDFORD HARBOR
ACUSHNET RIVER ESTUARY
TOTAL PCB CONCENTRATIONS, (0-12')

NEW BEDFORD HARBOR
COMMUNITY WORK GROUP PRESENTATION
FEBRUARY 16, 1989

OVERVIEW OF ESTUARY FEASIBILITY STUDY

- REMEDIAL TECHNOLOGIES SCREENING - MAY 1987
- DETAILED ANALYSIS OF TECHNOLOGIES - NOVEMBER 1987
- DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES - MAY 1988
- DETAILED EVALUATION OF ALTERNATIVES
  - ENGINEERING COMPLETED - JANUARY 1989
  - EVALUATION CRITERIA INITIATED - WAITING FOR MODEL RESULTS



ALTERNATIVE EST-2
NEW BEDFORD HARBOR FS
E.C.JORDAN CO.

4959 61

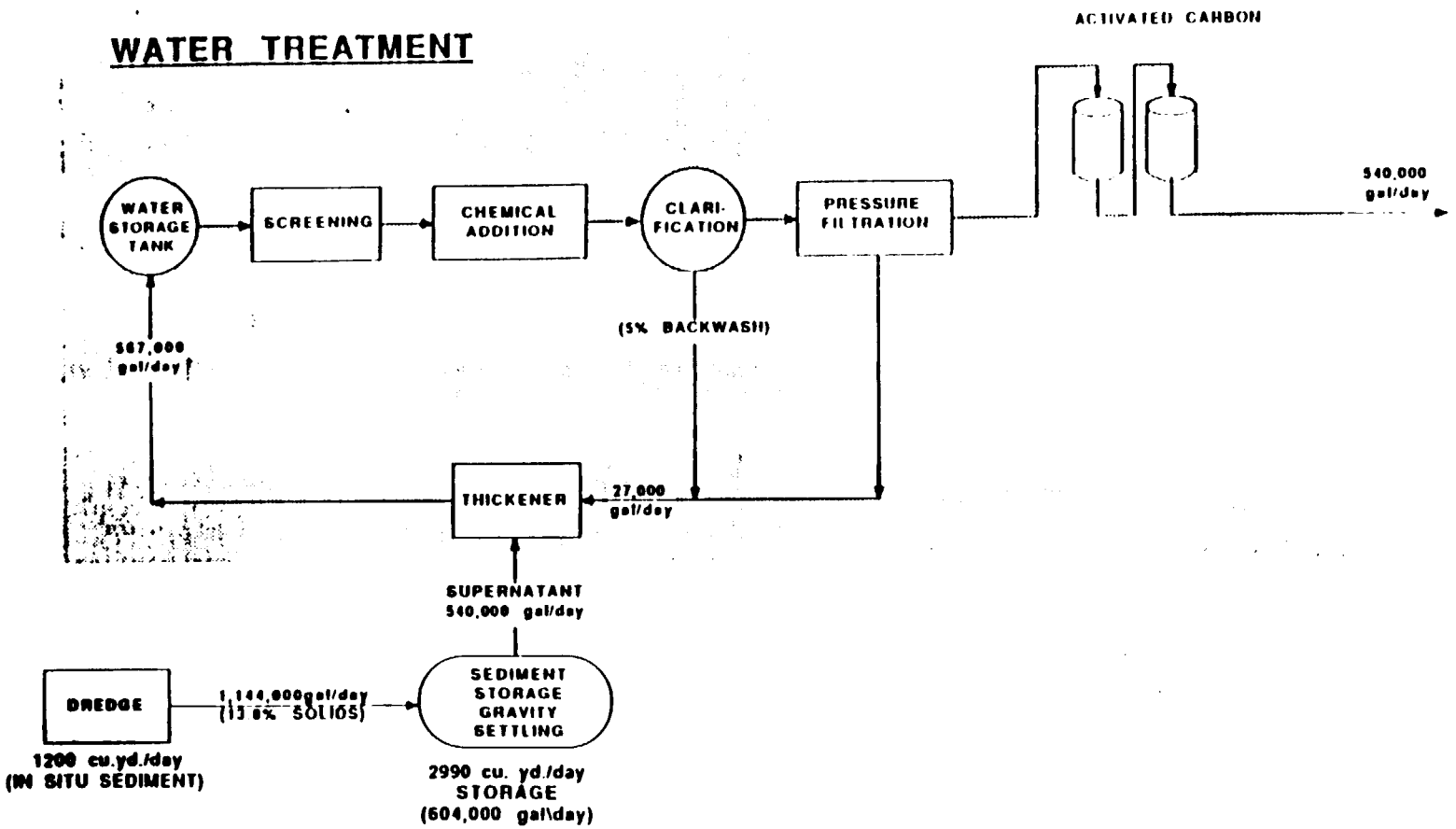


FIGURE 8-5
ALTERNATIVE EST. 2
MASS BALANCE

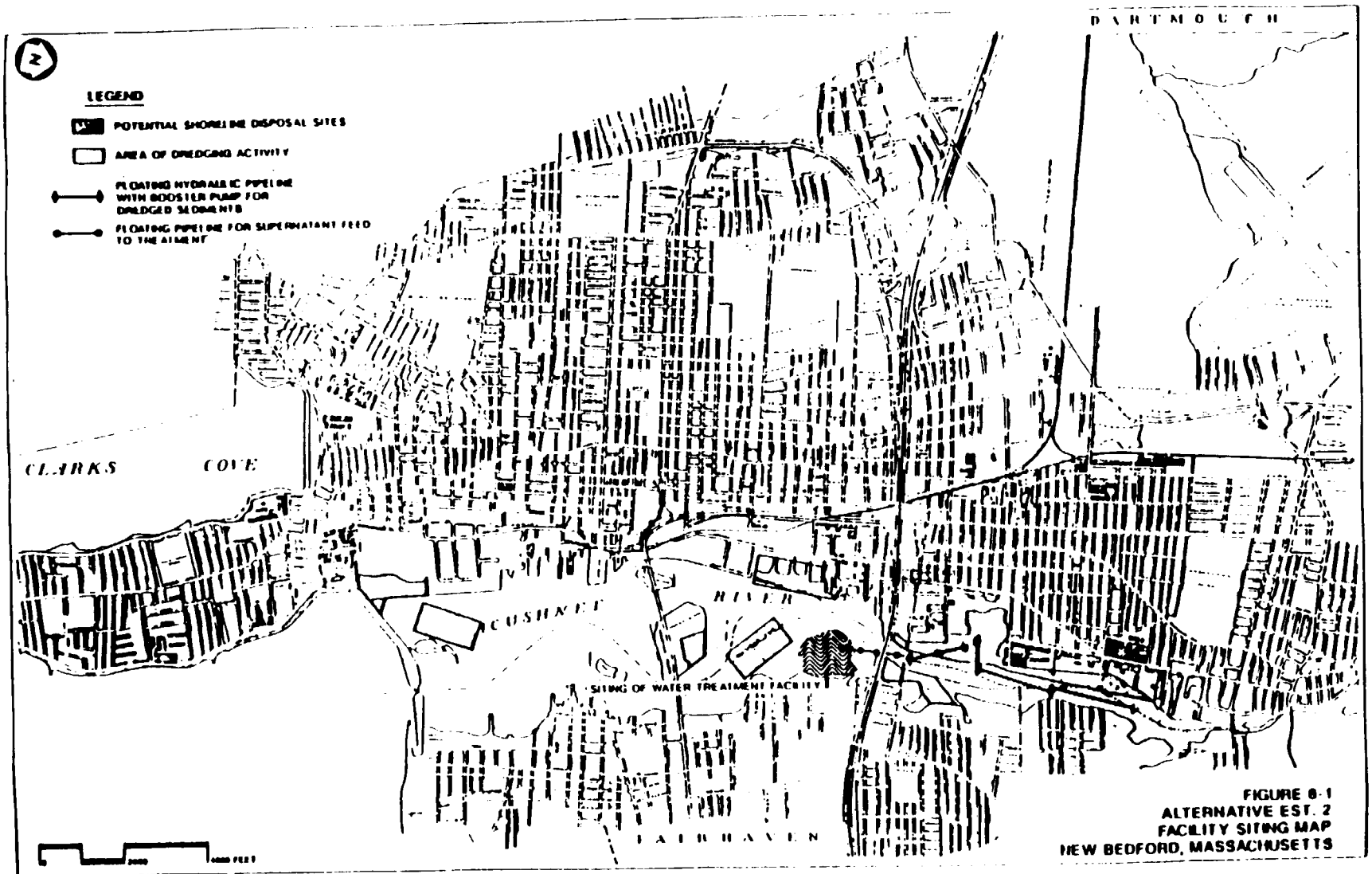
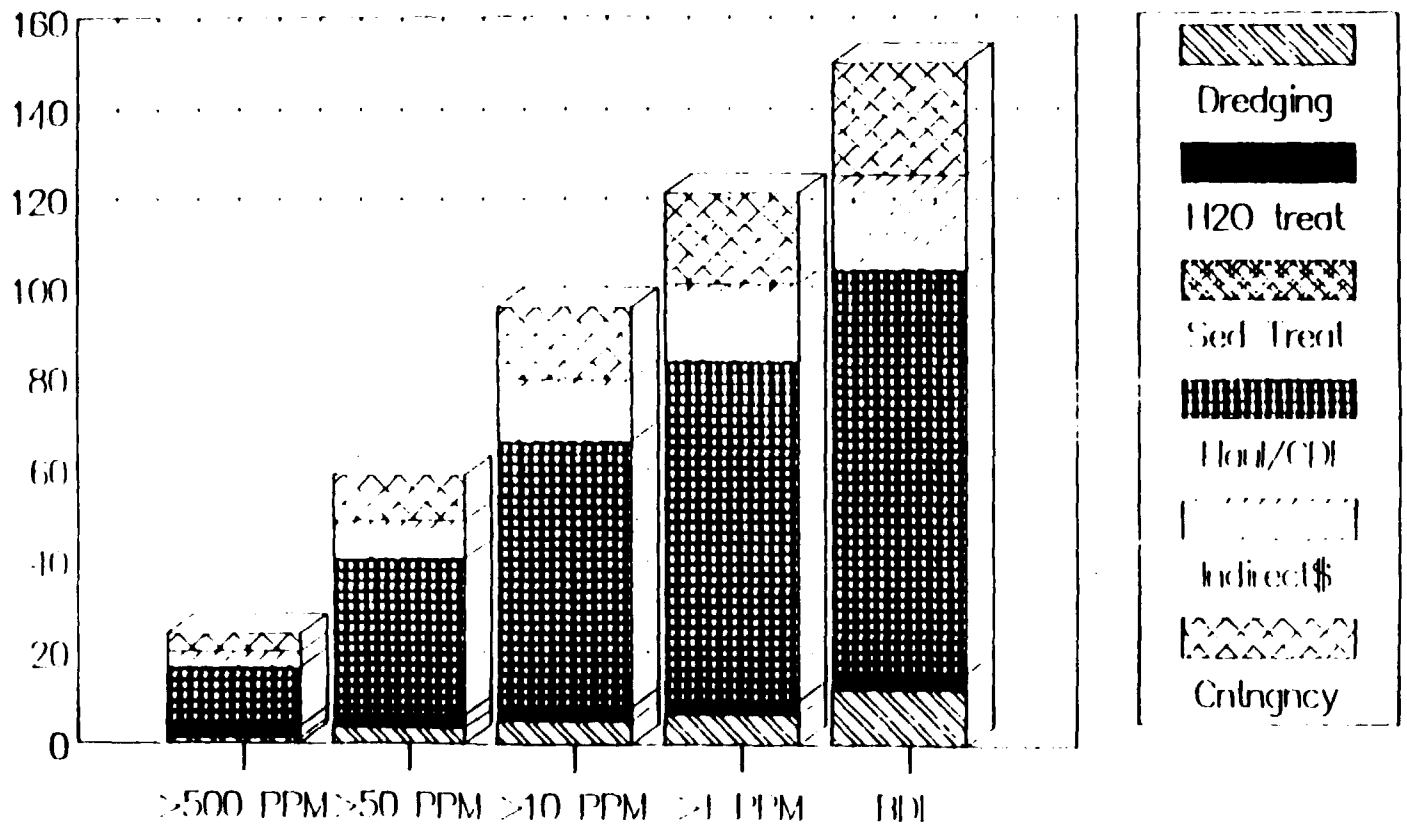


FIGURE 8-1
ALTERNATIVE EST. 2
FACILITY SITING MAP
NEW BEDFORD, MASSACHUSETTS

FIGURE 8-7

ALTERNATIVE EST-2

Capital Costs – Lined CDFs



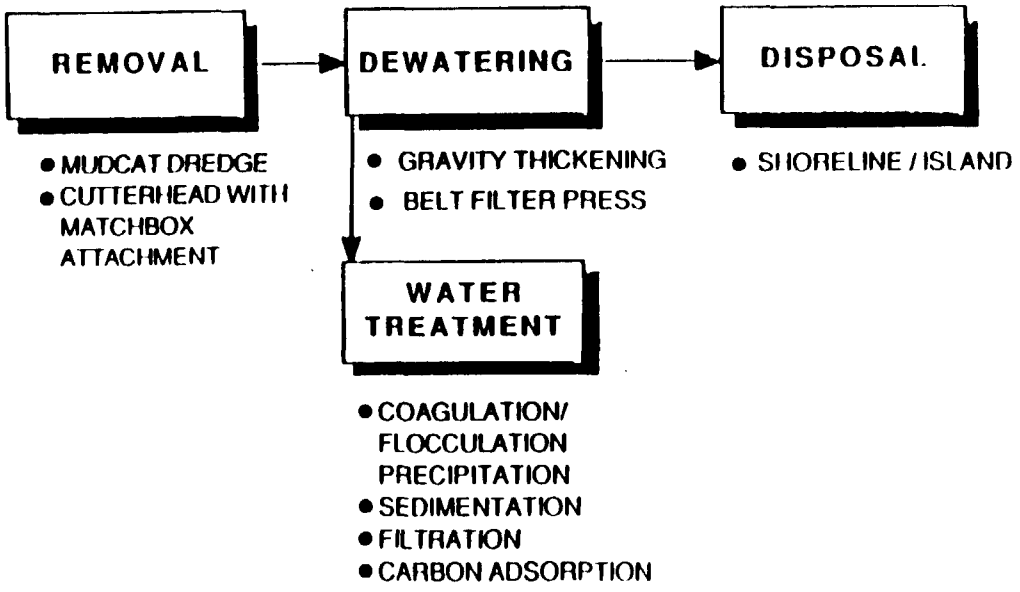
Dollars (Millions)

TABLE 8-1

COST ESTIMATE: ALTERNATIVE EST-2
DREDGE/DISPOSE
NEW BEDFORD HARBOR

ACTIVITY	COST >500 PPM($)	>50 PPM($)	>10 PPM($)	>1 PPM($)	BDL.$
1. CAPITAL AND O&M COSTS					
A. Dredging	1,162,774	3,398,881	5,098,326	6,462,356	11,918,460
B. Dewater/Water Treatment	2,616,878	2,353,181	3,032,772	3,176,918	3,753,499
C. Sediment Treatment	0	0	0	0	0
D. Material Hauling	58,130	120,026	317,689	358,457	439,647
E. CDFs - Unlined	5,945,900	22,966,327	38,439,950	49,601,191	59,493,371
F. CDFs - Lined	12,859,966	34,133,484	57,551,304	73,495,368	87,277,370
DIRECT UNLINED COSTS	9,783,682	29,338,415	46,888,737	59,598,923	75,605,377
DIRECT LINED COSTS	16,497,748	40,505,572	65,999,791	83,493,300	103,289,576
G. Health & Safety (@5%) Level D Protection [Activities: B,D]	133,750	148,660	167,523	176,769	209,657
H. Health & Safety (@15%) Level C Protection [Activities: None]					
I. Legal, Administration	489,184	1,466,921	2,344,437	2,979,946	3,780,279
Permitting (@5%)	824,387	2,025,279	3,299,990	4,174,665	5,169,479
J. Engineering (@10%)	978,368	2,933,842	4,688,874	5,959,892	7,560,558
	1,649,775	4,050,557	6,599,979	8,349,330	10,338,958
K. Services During	489,184	1,466,921	2,344,437	2,979,946	3,780,279
Construction (@5%)	824,887	2,025,279	3,299,990	4,174,665	5,169,479
INDIRECT UNLINED COSTS	2,090,487	6,016,343	9,545,270	12,096,553	15,330,773
INDIRECT LINED COSTS	3,433,300	8,249,775	13,367,481	16,875,429	20,887,572
SUBTOTAL UNLINED COSTS	11,874,169	35,354,759	56,434,007	71,695,476	90,936,350
SUBTOTAL LINED COSTS	19,931,048	48,755,347	79,367,272	100,368,729	124,277,148
CONTINGENCY - Unlined (@ 20%)	2,374,834	7,070,952	11,286,801	14,339,095	18,187,270
CONTINGENCY - Lined (@ 20%)	3,986,210	9,751,069	15,873,454	20,073,746	24,855,430
1. CAPITAL AND O&M COSTS	14,249,002	42,425,710	67,720,809	86,034,572	109,123,620
TOTAL CAPITAL AND O&M COSTS: LINED	23,917,257	58,506,416	95,240,727	120,442,475	149,132,578
PRESENT WORTH COSTS: UNLINED	12,339,145	35,889,974	57,288,329	71,118,308	68,161,146
PRESENT WORTH COSTS: LINED	20,709,842	49,493,426	80,568,767	99,560,733	120,484,448

10.88.103
0001.0.0



ALTERNATIVE EST-2D
NEW BEDFORD HARBOR FS
E.C.JORDAN CO.

4959 61

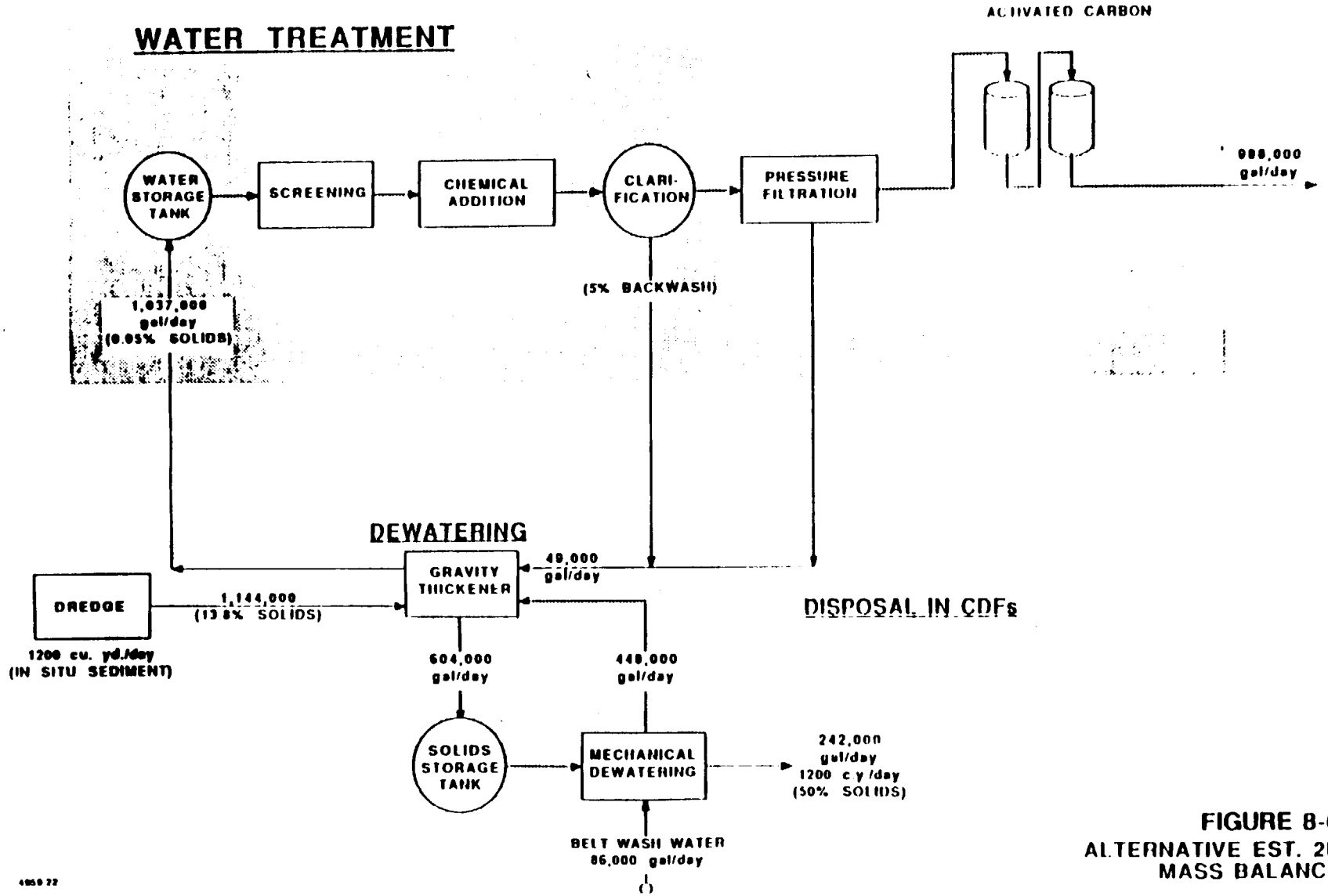


FIGURE 8-6
ALTERNATIVE EST. 2D
MASS BALANCE

FIGURE 8-10

ALTERNATIVE EST-2d

Capital Costs –Unlined CDFs

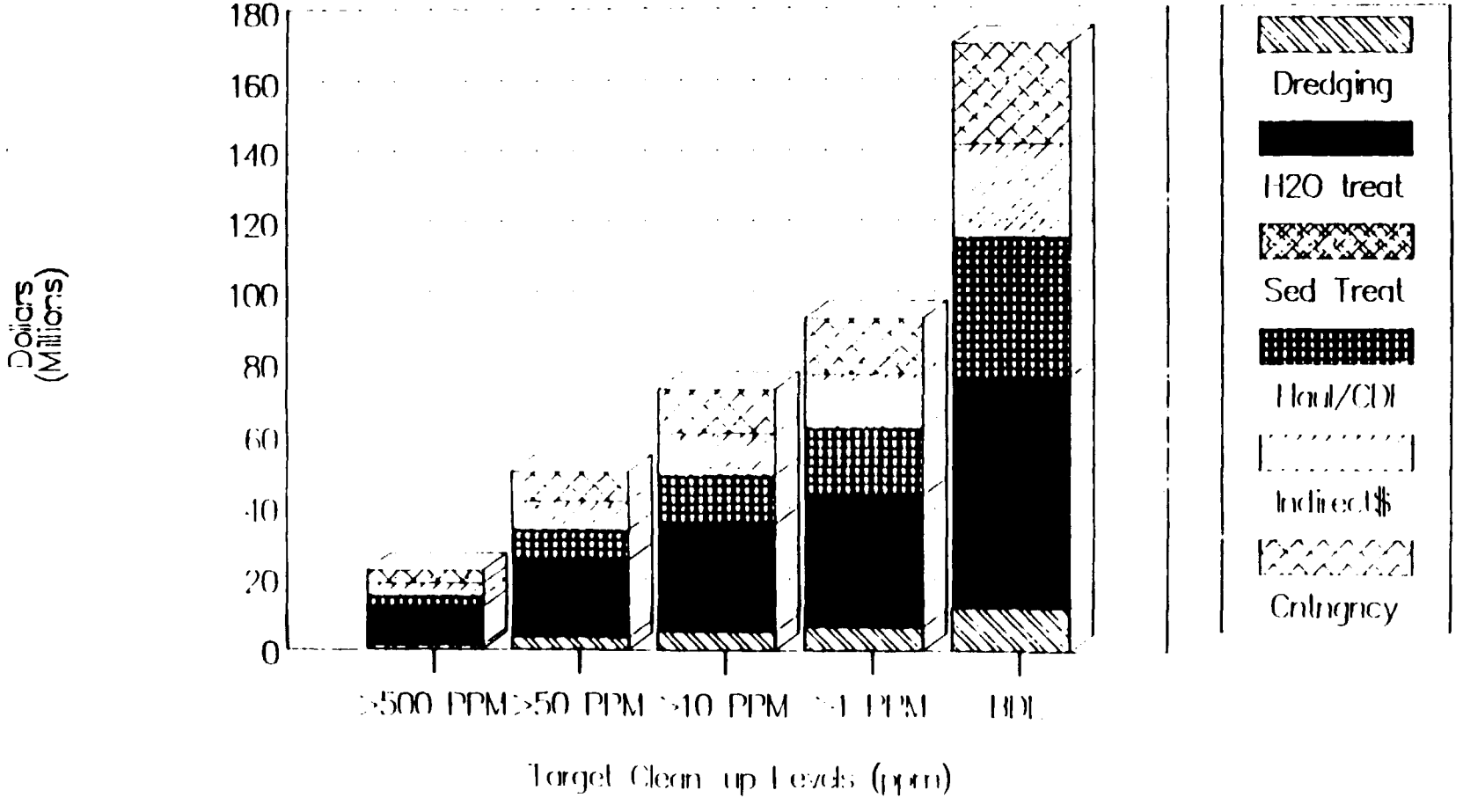
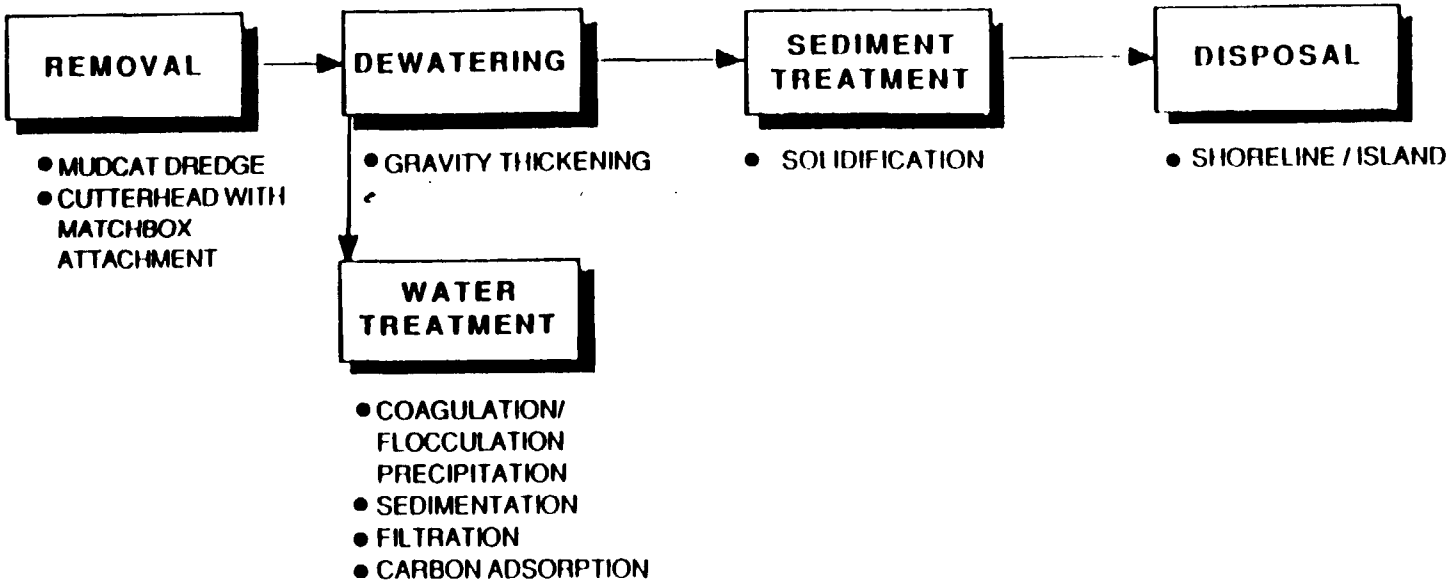


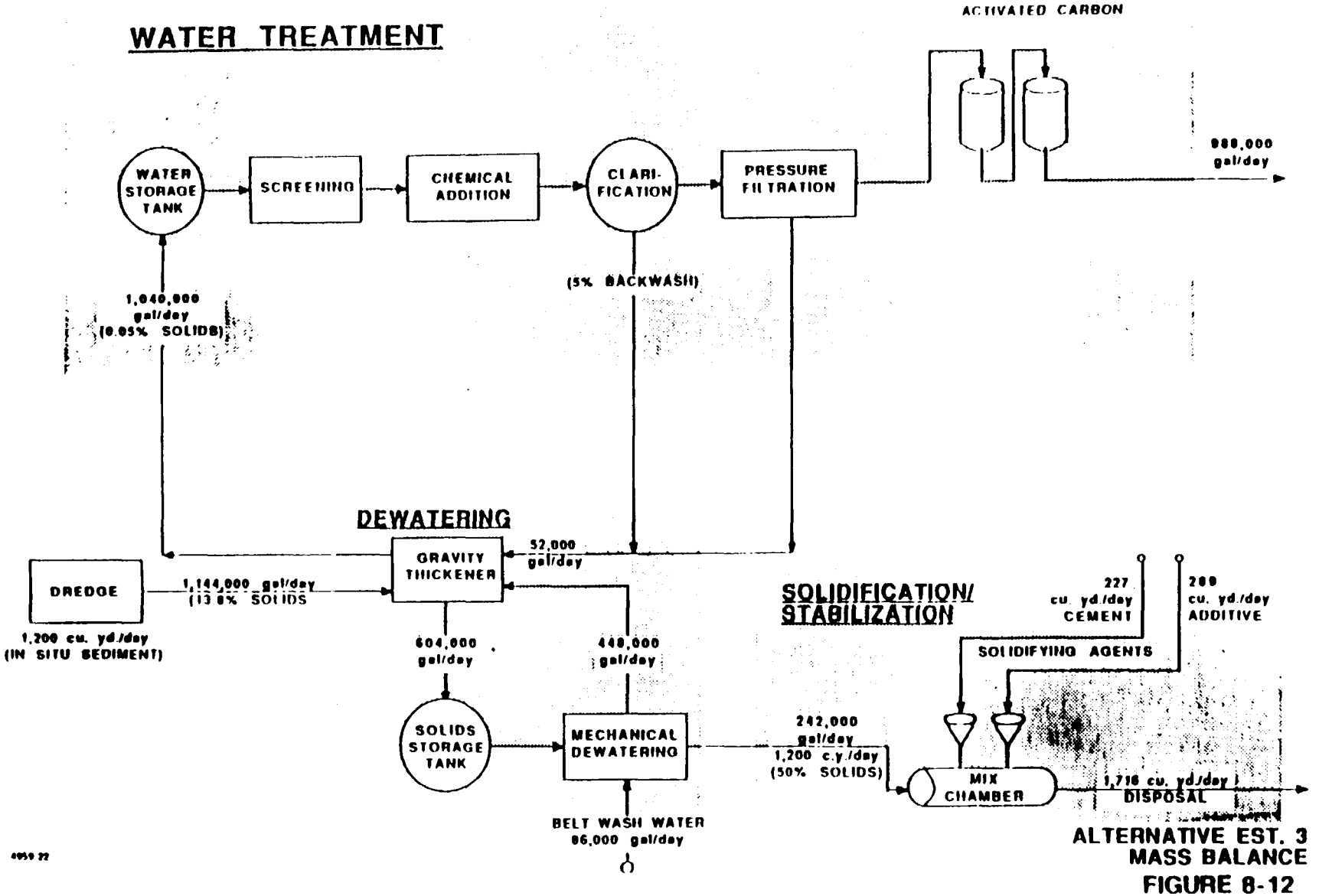
TABLE 8-3
COST ESTIMATE: ALTERNATIVE EST-2d
DREDGE/DEWATER/DISPOSE
NEW BEDFORD HARBOR

ACTIVITY	COST >500 PPM($)	>50 PPM($)	>10 PPM($)	>1 PPM($)	BDL($)
1. CAPITAL AND O&M COSTS					
A. Dredging	1,162,774	3,398,381	5,098,326	6,462,356	11,918,460
B. Dewater/Water Treatment	10,726,244	21,390,187	30,374,305	37,184,839	64,424,377
C. Sediment Treatment	0	0	0	0	0
D. Material Hauling	376,758	1,101,294	3,537,152	4,029,121	5,796,988
E. CDFs - Unlined	2,703,300	7,418,900	10,142,398	14,357,998	22,371,366
F. CDFs - Lined	3,093,200	14,716,700	17,154,946	22,378,446	50,026,682
DIRECT UNLINED COSTS	14,969,577	33,309,262	49,203,181	62,534,314	113,512,193
DIRECT LINED COSTS	21,258,977	41,107,062	56,215,229	70,554,762	132,467,307
G. Health & Safety (@5%) Level D Protection (Activities: B,D)	555,150	1,149,574	1,698,098	2,060,698	3,511,093
H. Health & Safety (@15%) Level C Protection (Activities: None)					
I. Legal, Administration Permitting (@5%)	748,479	1,690,463	2,460,159	3,126,716	5,750,610
J. Engineering (@10%)	1,062,949	2,055,353	2,810,761	3,527,738	6,623,350
	1,496,958	3,380,926	4,920,318	6,253,431	11,501,219
K. Services During Construction (@5%)	2,125,898	4,110,706	5,621,523	7,055,476	13,246,701
	748,479	1,690,463	2,460,159	3,126,716	5,750,610
	1,062,949	2,055,353	2,810,761	3,527,738	6,623,350
INDIRECT UNLINED COSTS	3,549,065	7,911,426	11,538,734	14,567,561	26,513,532
INDIRECT LINED COSTS	4,806,945	9,370,986	12,941,144	16,171,650	30,044,495
SUBTOTAL UNLINED COSTS	18,518,642	41,720,688	60,741,915	77,101,874	141,525,724
SUBTOTAL LINED COSTS	26,065,922	50,478,048	69,156,373	86,726,412	162,471,501
CONTINGENCY - Unlined (@ 20%)	3,703,728	8,344,138	12,148,383	15,420,375	28,305,145
CONTINGENCY - Lined (@ 20%)	5,213,184	10,095,610	13,831,275	17,345,282	32,494,300
TOTAL CAPITAL AND O&M COSTS: UNLINED	22,222,371	50,064,826	72,890,298	92,522,249	169,830,869
TOTAL CAPITAL AND O&M COSTS: LINED	31,279,107	60,573,658	82,987,647	104,071,694	194,965,801
PRESENT WORTH COSTS: UNLINED	19,242,247	42,352,273	61,661,451	76,481,183	137,206,630
PRESENT WORTH COSTS: LINED	27,084,433	51,242,206	70,203,290	86,028,240	157,513,182



ALTERNATIVE EST-3
NEW BEDFORD HARBOR FS
E.C.JORDAN CO.

4959-61



ALTERNATIVE EST. 3
MASS BALANCE
FIGURE 8-12

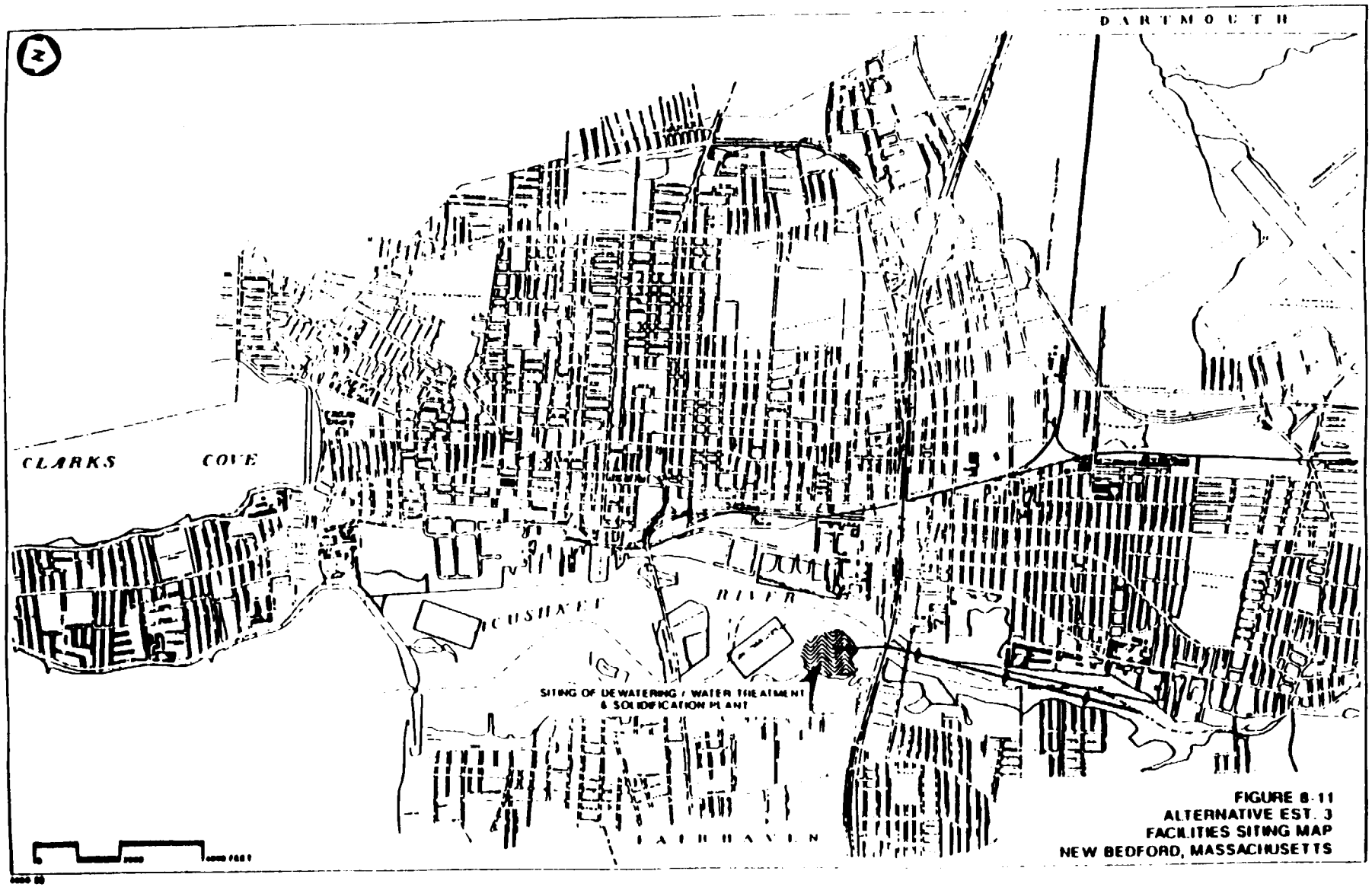


FIGURE 8-11
ALTERNATIVE EST. 3
FACILITIES SITING MAP
NEW BEDFORD, MASSACHUSETTS

FIGURE 8-14

ALTERNATIVE EST-3

Capital Costs --Unlined CDFs

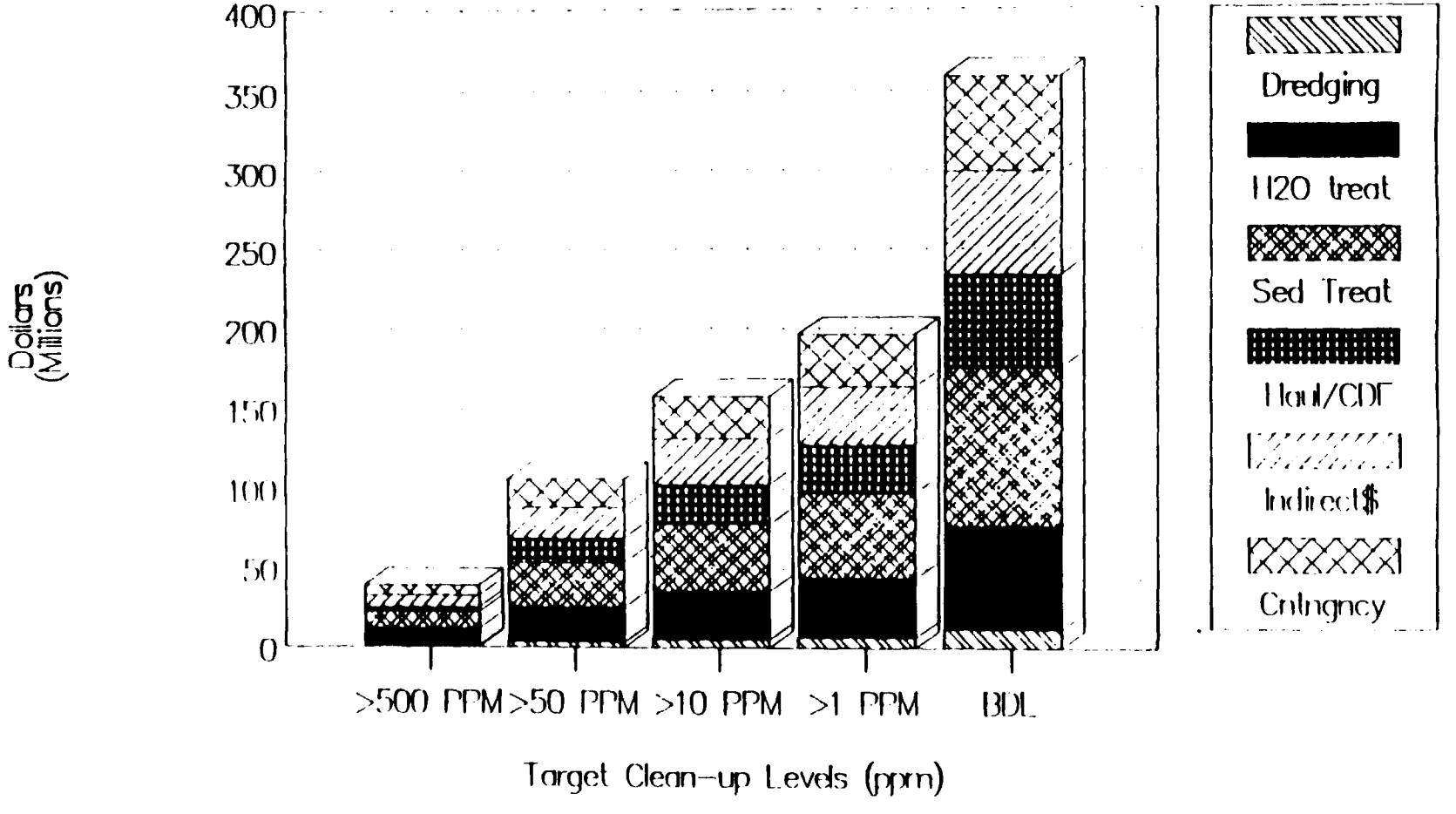
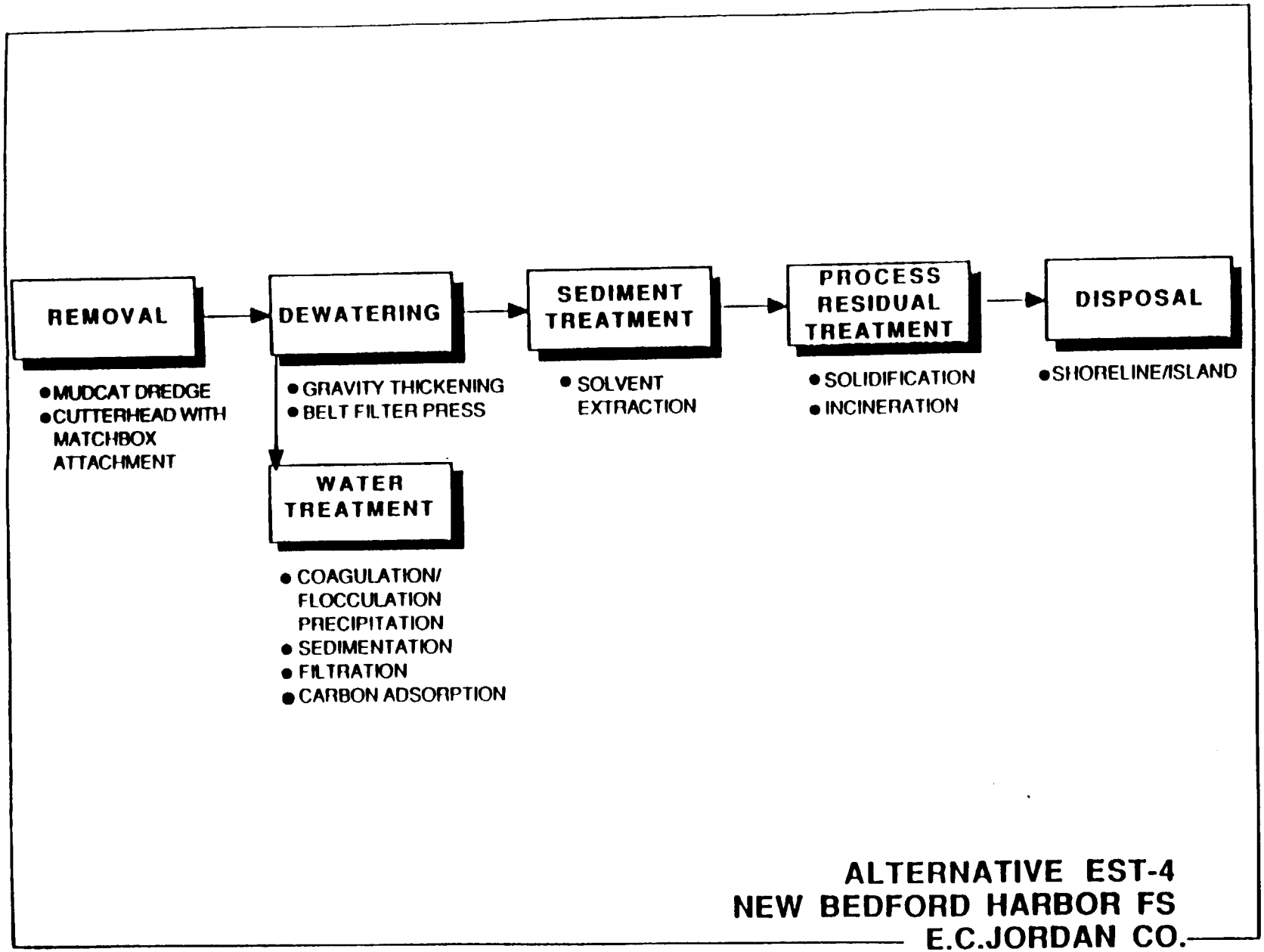


TABLE 8-5
COST ESTIMATE: ALTERNATIVE EST-3
DREDGE/DEWATER/SOLIDIFY/DISPOSE
NEW BEDFORD HARBOR

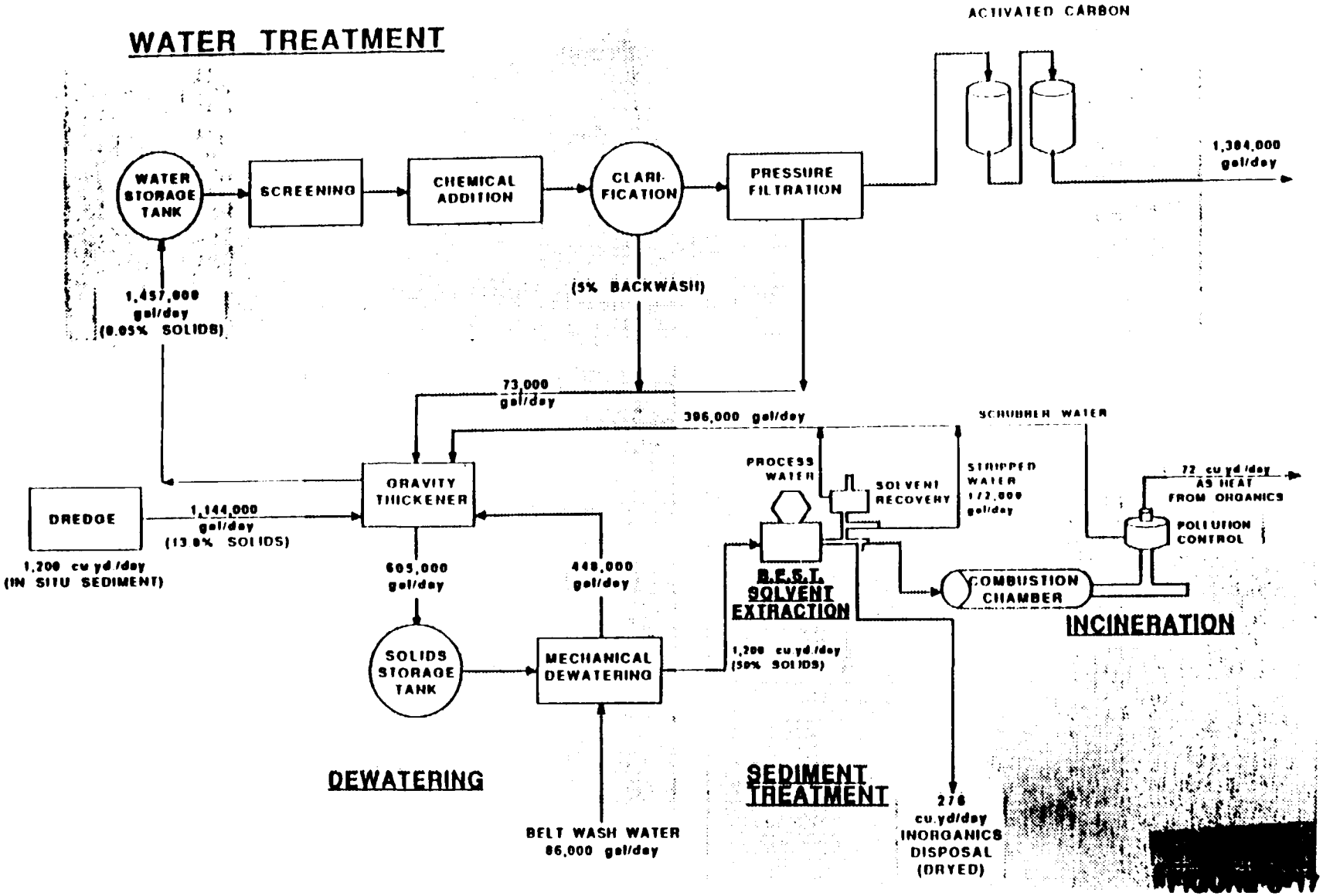
ACTIVITY	COST >500 PPM($)	>50 PPM($)	>10 PPM($)	>1 PPM($)	BDL($)
1. CAPITAL AND O&M COSTS					
A. Dredging	1,162,774	3,398,881	5,098,326	6,462,356	11,918,460
B. Dewater/Water Treatment	10,726,244	21,890,187	30,374,805	37,184,839	64,424,377
C. Sediment Treatment	10,231,450	28,148,080	42,222,160	53,518,480	98,703,600
D. Material Hauling	540,485	1,579,381	4,302,464	4,936,498	7,472,625
E. CDFs - Unlined	2,703,800	14,138,200	20,647,096	25,599,827	51,238,392
F. CDFs - Lined	8,993,200	22,329,366	30,338,462	38,434,984	76,351,139
DIRECT UNLINED COSTS	25,364,754	69,155,229	102,644,851	127,702,301	233,808,455
DIRECT LINED COSTS	31,654,154	78,846,595	112,336,217	140,537,158	259,370,752
G. Health & Safety (@5%) Level D Protection [Activities: B,D]	563,336	1,173,503	1,733,363	2,106,067	3,394,375
H. Health & Safety (@15%) Level C Protection [Activities: C]	1,534,718	4,222,212	6,333,324	8,027,772	14,305,340
I. Legal, Administration	1,268,238	3,457,761	5,132,243	6,385,100	11,690,423
Permitting (@5%)	1,582,708	3,942,330	5,616,811	7,026,858	12,968,538
J. Engineering (@10%)	2,536,475	6,915,523	10,264,485	12,770,200	23,380,845
	3,165,415	7,884,660	11,233,622	14,053,716	25,937,075
K. Services During	1,268,238	3,457,761	5,132,243	6,385,100	11,690,423
Construction (@5%)	1,582,708	3,942,330	5,616,811	7,026,858	12,968,538
INDIRECT UNLINED COSTS	7,171,005	19,226,761	28,596,158	35,674,239	65,162,106
INDIRECT LINED COSTS	8,428,885	21,165,034	30,534,431	38,241,270	70,274,565
SUBTOTAL UNLINED COSTS	32,535,759	88,381,991	131,241,009	163,376,240	298,970,561
SUBTOTAL LINED COSTS	40,083,039	100,011,630	142,870,648	178,778,428	329,645,317
CONTINGENCY - Unlined (@ 20%)	6,507,152	17,676,398	26,248,202	32,675,248	59,794,112
CONTINGENCY - Lined (@ 20%)	8,016,608	20,002,326	28,574,130	35,755,686	65,929,063
TOTAL CAPITAL AND O&M COSTS: UNLINED	39,042,911	106,058,389	157,489,211	196,051,488	358,764,673
TOTAL CAPITAL AND O&M COSTS: LINED	48,099,647	120,013,956	171,444,778	214,534,114	395,574,380
PRESENT WORTH COSTS: UNLINED	33,807,074	89,719,954	133,227,790	162,061,016	289,846,551
PRESENT WORTH COSTS: LINED	41,649,260	101,625,647	145,033,183	177,339,213	319,585,173

10.88.103
0005.0.0



ALTERNATIVE EST-4
NEW BEDFORD HARBOR FS
E.C.JORDAN CO.

4959 61



ALTERNATIVE EST. 4 SOLVENT EXTRACTION MASS BALANCE

4050 22

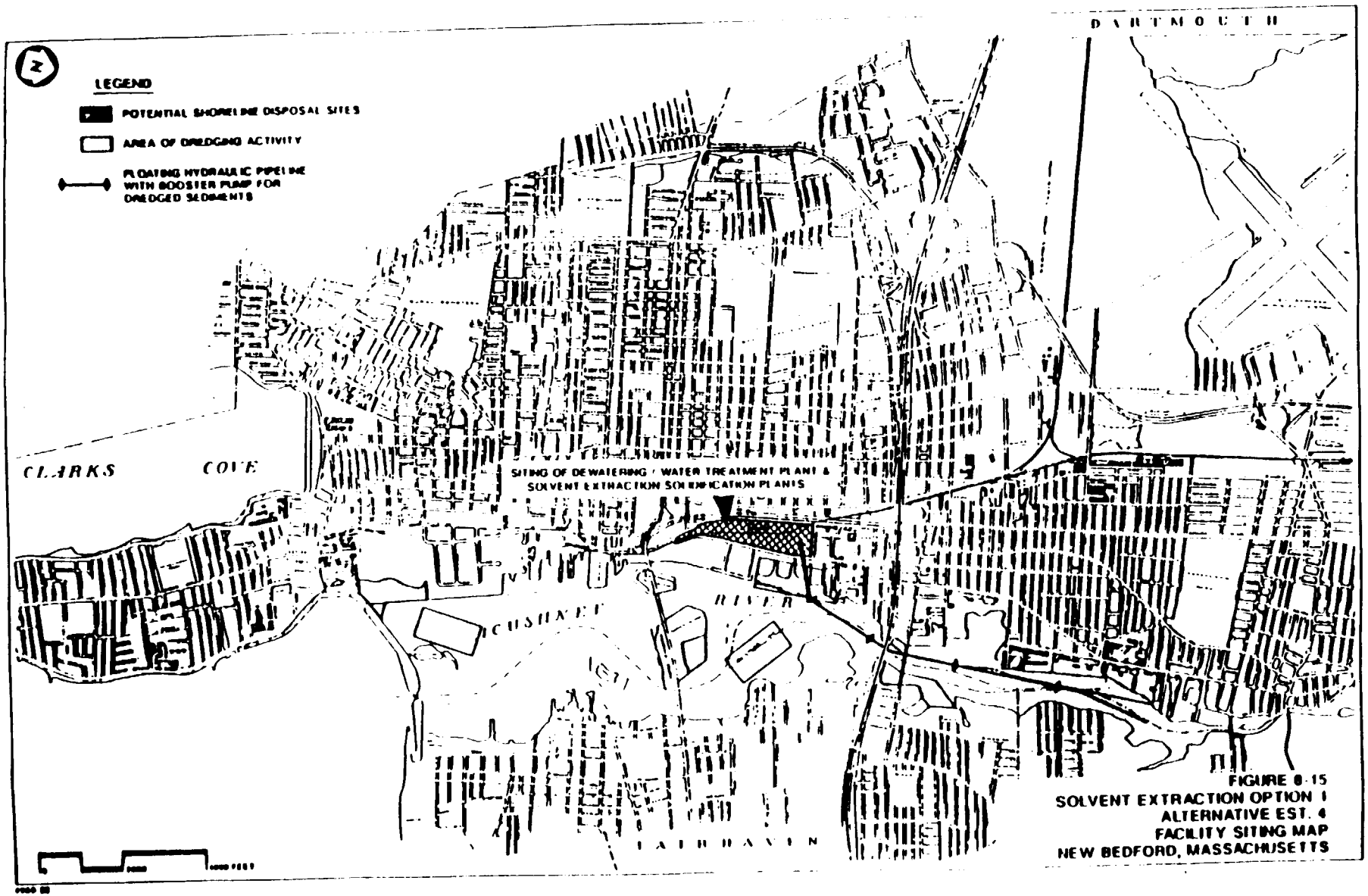


FIGURE 8-15
SOLVENT EXTRACTION OPTION 1
ALTERNATIVE EST. 4
FACILITY SITING MAP
NEW BEDFORD, MASSACHUSETTS

FIGURE 8-21

ALTERNATIVE EST-4

Capital Costs – Unlined CDFs

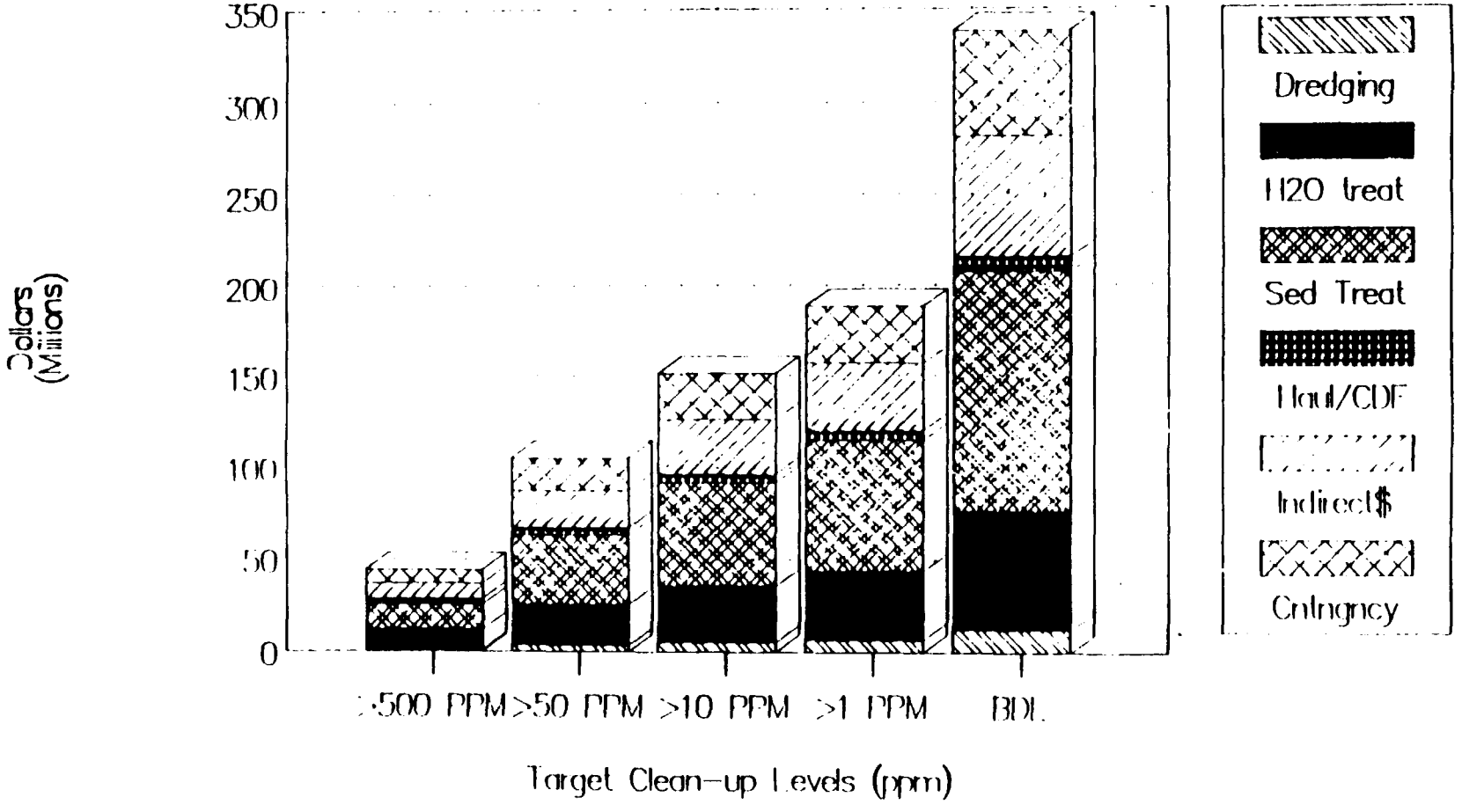
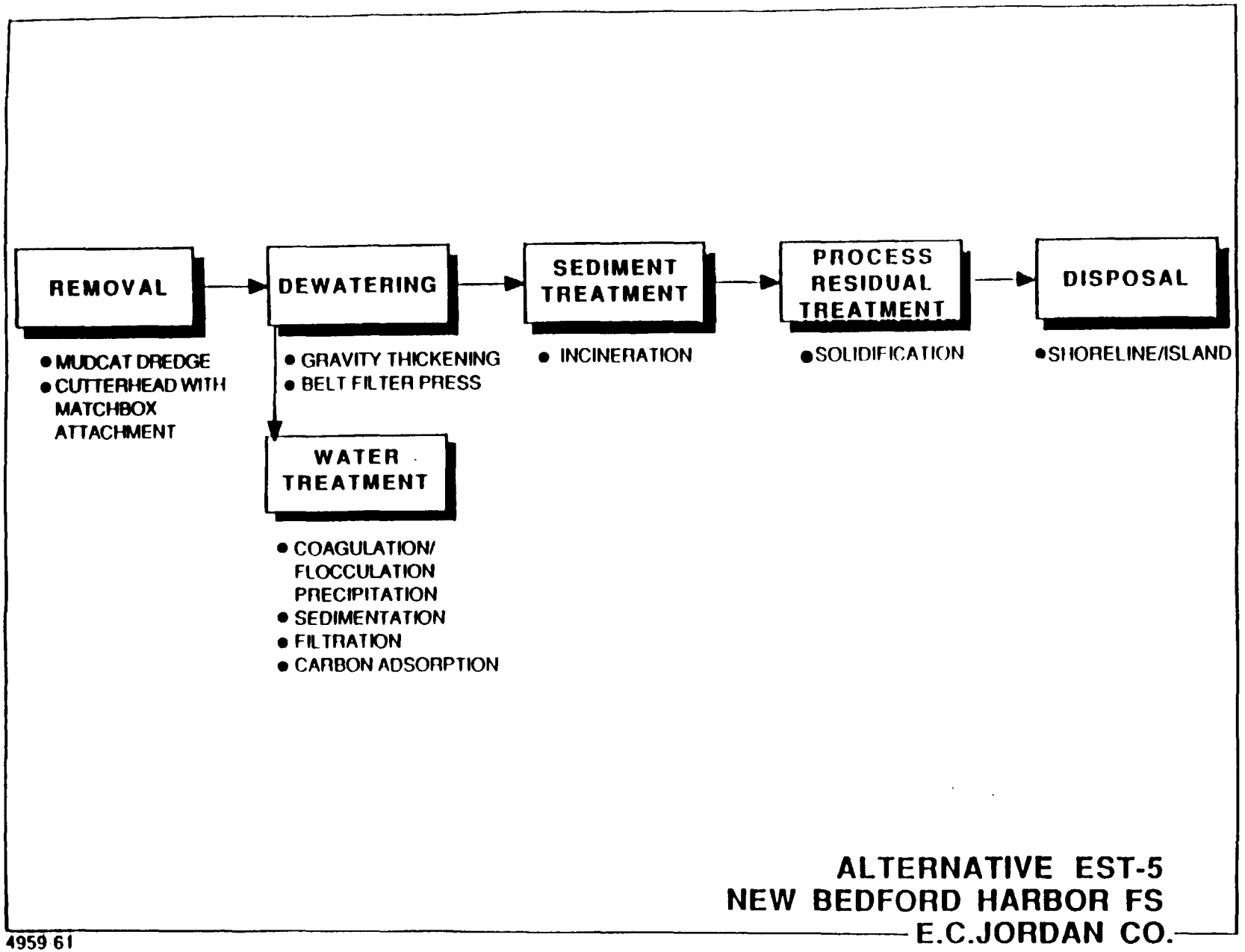


TABLE 8-8
COST ESTIMATE: ALTERNATIVE EST-4
DREDGE/DEWATER/SOLVENT EXTRACTION/DISPOSE
NEW BEDFORD HARBOR

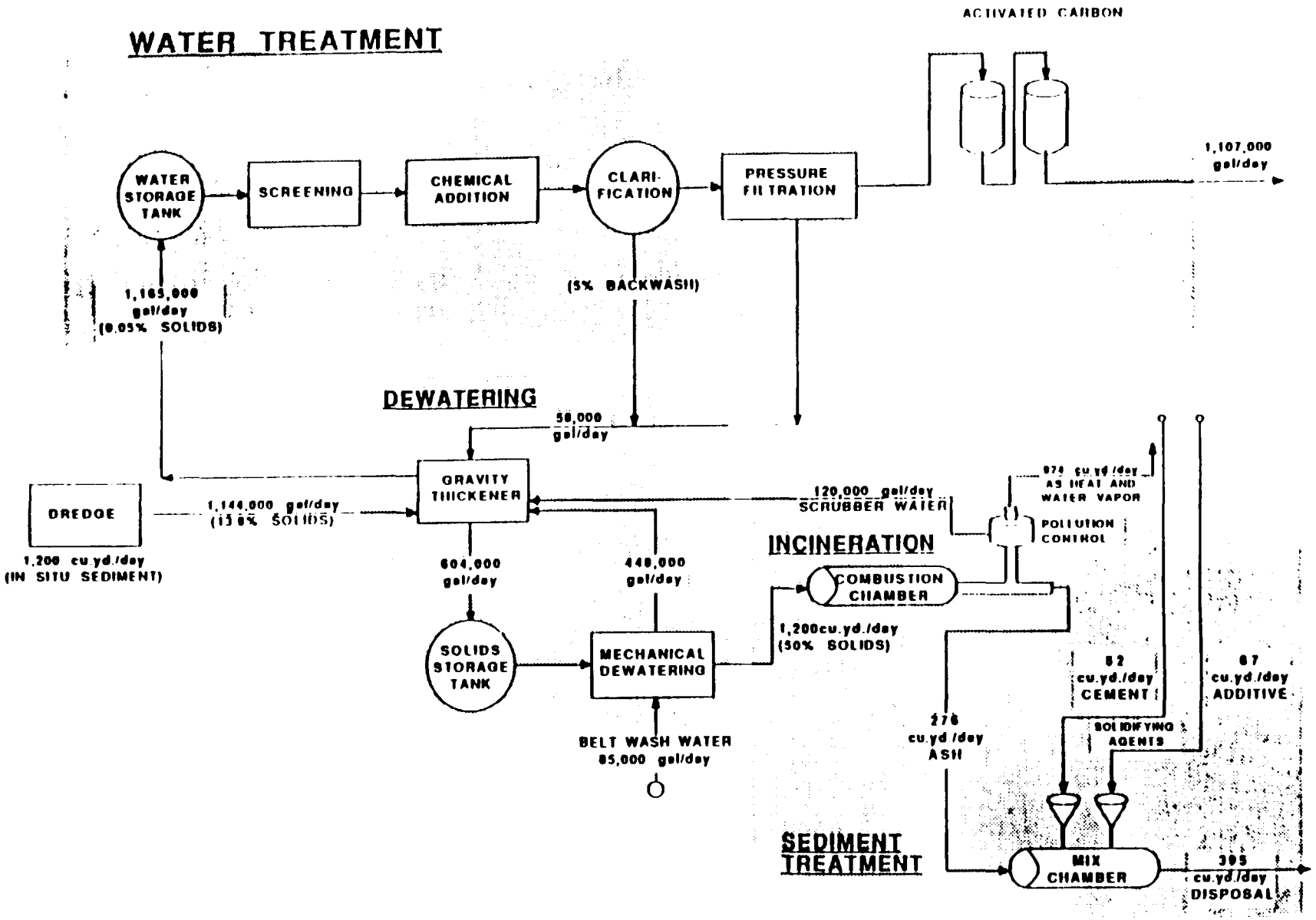
ACTIVITY	COST >500 PPM($)	>50 PPM($)	>10 PPM($)	>1 PPM($)	BDL($)
1. CAPITAL AND O&M COSTS					
A. Dredging	1,162,774	3,398,881	5,098,326	6,462,356	11,918,460
B. Dewater/Water Treatment	10,726,244	21,890,187	30,374,805	37,184,839	64,424,377
C. Sediment Treatment	13,468,943	37,832,318	56,348,529	71,210,250	130,656,324
D. Material Hauling	465,627	1,361,065	2,041,600	2,587,819	4,772,689
E. CDFs - Unlined	2,703,300	2,703,300	2,703,300	2,703,300	3,634,202
F. CDFs - Lined	3,993,200	3,993,200	3,993,200	3,993,200	10,846,350
DIRECT UNLINED COSTS	28,327,388	67,186,251	96,567,060	120,149,565	215,406,351
DIRECT LINED COSTS	34,316,788	73,475,651	102,856,460	126,438,465	222,418,999
G. Health & Safety (@5%) Level D Protection [Activities: B,D]	559,594	1,162,563	1,620,820	1,988,633	3,459,373
H. Health & Safety (@15%) Level C Protection [Activities: C]	2,020,341	5,674,348	8,452,279	10,681,538	19,398,339
I. Legal, Administration	1,426,369	3,359,313	4,828,353	6,007,453	10,770,348
Permitting (@5%)	1,740,839	3,673,783	5,142,823	6,321,923	11,120,950
J. Engineering (@10%)	2,852,739	6,718,625	9,656,706	12,014,906	21,540,695
	3,481,679	7,347,565	10,285,646	12,643,846	22,241,900
K. Services During	1,426,369	3,359,313	4,828,353	6,007,453	10,770,348
Construction (@5%)	1,740,839	3,673,783	5,142,823	6,321,923	11,120,950
INDIRECT UNLINED COSTS	8,285,413	20,274,660	29,386,512	36,699,983	66,139,307
INDIRECT LINED COSTS	9,543,293	21,532,540	30,644,392	37,957,863	67,542,217
SUBTOTAL UNLINED COSTS	36,812,801	87,460,911	125,953,572	156,849,048	281,546,758
SUBTOTAL LINED COSTS	44,360,081	95,008,191	133,500,852	164,396,328	289,961,216
CONTINGENCY - Unlined (@ 20%)	7,362,560	17,492,182	25,190,714	31,369,810	56,309,352
CONTINGENCY - Lined (@ 20%)	8,872,016	19,001,638	26,700,170	32,879,266	57,992,243
TOTAL CAPITAL AND O&M COSTS: UNLINED	44,175,361	104,953,094	151,144,286	188,218,858	337,856,110
TOTAL CAPITAL AND O&M COSTS: LINED	53,232,097	114,009,830	160,201,022	197,275,594	347,953,459
PRESENT WORTH COSTS: UNLINED	38,251,239	88,784,931	127,860,309	155,386,370	272,954,490
PRESENT WORTH COSTS: LINED	46,093,425	96,446,465	135,521,843	163,072,892	281,112,155

10.88.103
0007.0.0



ALTERNATIVE EST-5
NEW BEDFORD HARBOR FS
E.C.JORDAN CO.

4959 61



ALTERNATIVE EST. 5 INCINERATION MASS BALANCE

FIGURE 8-23

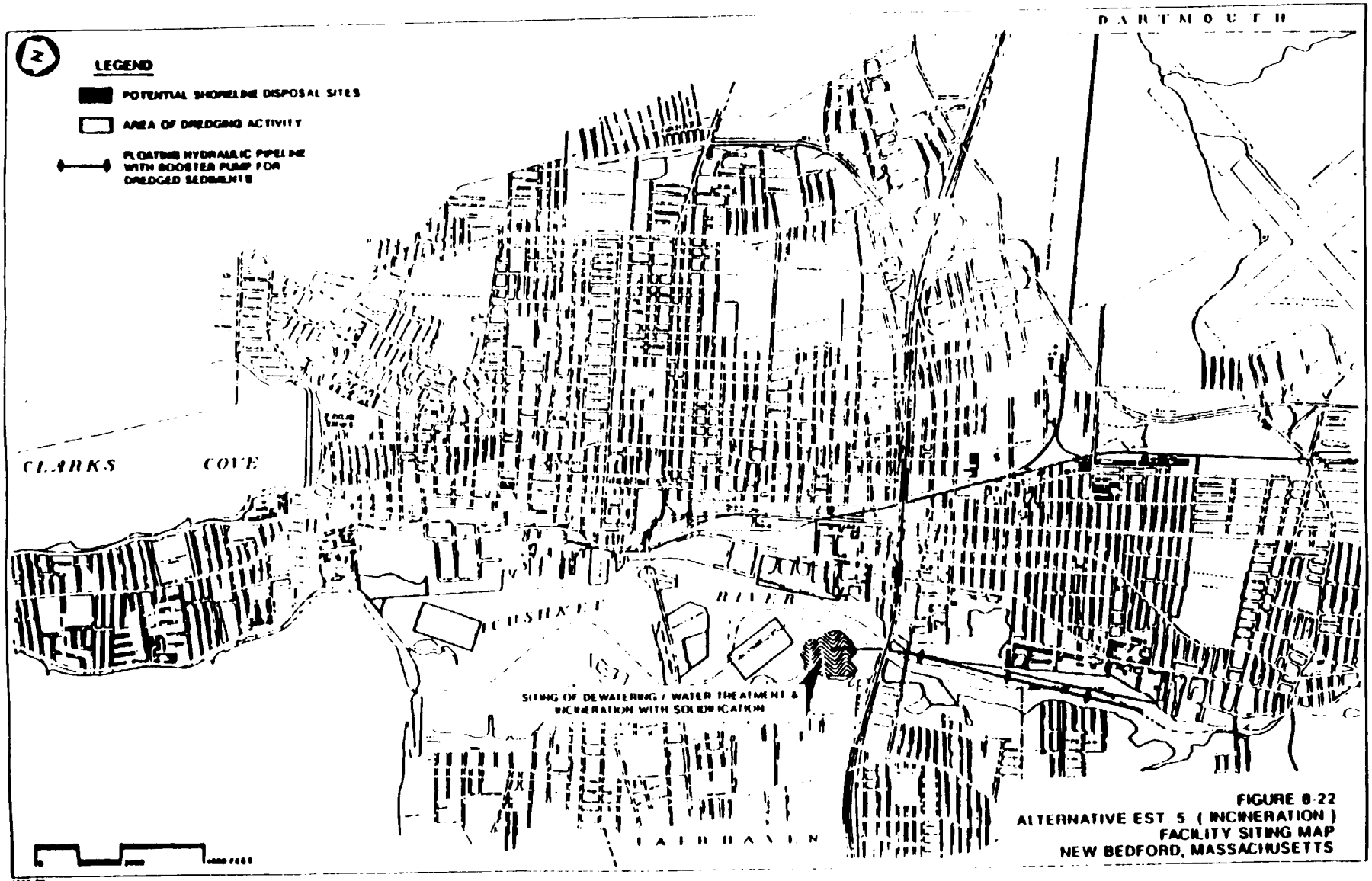


FIGURE 8-22
ALTERNATIVE EST 5 (INCINERATION)
FACILITY SITING MAP
NEW BEDFORD, MASSACHUSETTS

ALTERNATIVE EST-5

Capital Costs – Unlined CDFs

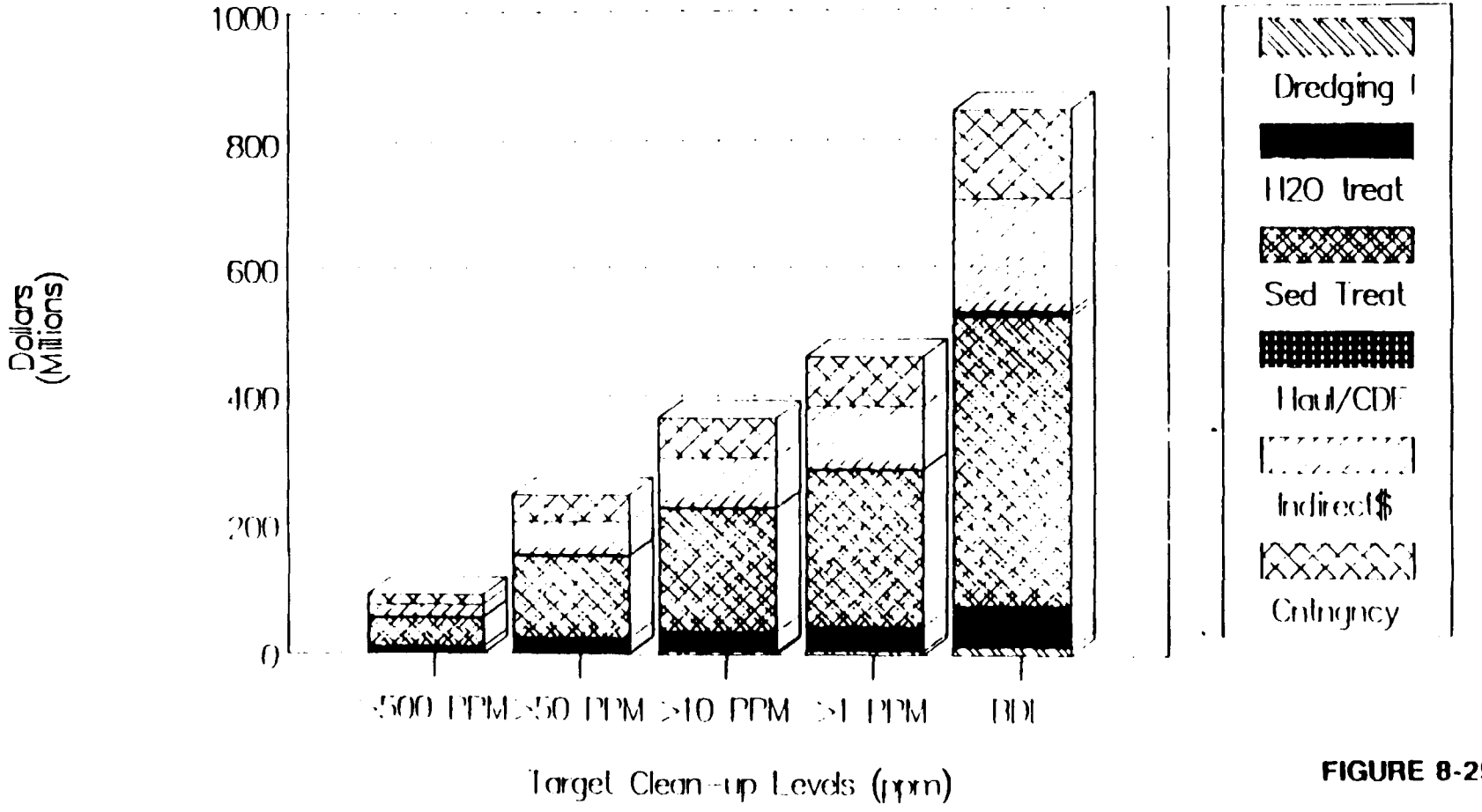


FIGURE 8-25

TABLE 8-10
COST ESTIMATE: ALTERNATIVE EST-5
DREDGE/DEWATER/INCINERATION/DISPOSE
NEW BEDFORD HARBOR

ACTIVITY	COST >500 PPM($)	>50 PPM($)	>10 PPM($)	>1 PPM($)	BDL($)
1. CAPITAL AND O&M COSTS					
A. Dredging	1,162,774	3,398,881	5,098,326	6,462,356	11,918,460
B. Dewater/Water Treatment	10,726,244	21,890,187	30,374,805	37,184,339	64,424,377
C. Sediment Treatment	43,279,034	126,508,027	189,762,220	240,532,119	443,610,992
D. Material Hauling	125,499	366,344	550,267	697,488	1,286,371
E. CDFs - Unlined	2,703,300	2,703,300	2,703,300	2,703,300	3,349,102
F. CDFs - Lined	3,993,200	3,993,200	3,993,200	3,993,200	16,269,550
DIRECT UNLINED COSTS	57,997,352	154,867,739	228,489,418	287,580,602	529,589,301
DIRECT LINED COSTS	64,286,752	161,157,139	234,778,818	293,370,302	537,610,249
G. Health & Safety (@5%) Level D Protection [Activities: B,D]	542,587	1,112,852	1,546,254	1,894,116	3,285,362
H. Health & Safety (@15%) Level C Protection [Activities: C]	6,491,355	18,976,204	28,464,333	36,079,318	66,541,649
I. Legal, Administration	2,399,868	7,743,287	11,424,471	14,379,030	26,479,490
Permitting (@5%)	3,214,338	8,057,357	11,738,941	14,693,500	26,380,512
J. Engineering (@10%)	5,799,735	15,486,774	22,848,942	28,758,060	52,958,980
	6,428,675	16,115,714	23,477,882	29,387,000	53,761,025
K. Services During Construction (@5%)	2,899,868	7,743,387	11,424,471	14,379,030	26,479,490
	3,214,338	8,057,857	11,738,941	14,693,500	26,380,512
INDIRECT UNLINED COSTS	18,633,913	51,062,604	75,708,470	95,490,055	175,745,171
INDIRECT LINED COSTS	19,891,793	52,320,484	76,966,350	96,747,935	177,349,261
SUBTOTAL UNLINED COSTS	76,631,264	205,930,343	304,197,889	383,070,656	705,334,973
SUBTOTAL LINED COSTS	84,178,544	213,477,623	311,745,169	390,617,936	714,959,510
CONTINGENCY - Unlined (@ 20%)	15,326,253	41,186,069	60,839,578	76,614,131	141,066,995
CONTINGENCY - Lined (@ 20%)	16,835,709	42,695,525	62,349,034	78,123,587	142,991,902
TOTAL CAPITAL AND O&M COSTS: UNLINED	91,957,517	247,116,412	365,037,467	459,684,788	846,401,967
TOTAL CAPITAL AND O&M COSTS: LINED	101,014,253	256,173,148	374,094,203	468,741,524	857,951,412
PRESENT WORTH COSTS: UNLINED	79,625,585	209,047,802	308,802,962	379,986,832	683,809,499
PRESENT WORTH COSTS: LINED	87,467,770	216,709,336	316,464,496	387,473,355	693,140,314

C

Legal / SARA / NCP 4.1

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION I

DATE: May 26, 1987

SUBJ: Development of Alternatives - Feasibility Study

FROM: Maggie Leshen, Superfund Support Section

TO: Frank Ciavattieri, RPM, New Bedford Harbor

On May 21, 1987 I briefly met with Doug Allen of E.C. Jordan. We discussed the screening criteria and the use of cost-effectiveness. We agreed that cost-effectiveness has not been fully defined except when screening two alternatives that achieve similar results that the more costly alternative should be screened out.

Doug asked about the need to develop the five alternatives as stated in the NCP (§300.68(f). SARA requires compliance with ARARs unless one of the waiver criteria in SARA §121 (d)(4) are met. In addition SARA §121 (a) requires compliance with SARA 121 and to the extent practicable the national contingency plan. Since SARA is the governing law and the NCP §300.68 (f) language on developing the five alternatives states to the extent it is both possible and appropriate, it would be advisable to screen out alternatives that do not achieve site objectives or compliance with ARARs. The OSWER directive "Interim Guidance on Superfund Selection of Remedy" (p. 5) has suggestions on alternatives that should be developed to evaluate SARA's preference for treatment remedies that significantly reduce toxicity, mobility and volume. (Treatment alternatives should be developed ranging from an alternative that, to the degree possible, would eliminate the need for long-term management (including monitoring) at the site to alternatives involving treatment that would reduce toxicity, mobility or volume as their principal element, although alternatives may involve different technologies for different types of waste, they will vary mainly in the degree to which they rely on long-term management of treatment residuals or low-concentrated wastes. In addition to the range of treatment alternatives a containment option involving little or no treatment and a no action alternative should be developed.)

I feel it would be advisable to discuss this matter with the site attorney before formally notifying E.C. Jordan. Since E.C. Jordan is in the process of developing and initially screening alternatives, prompt concurrence on this issue is advisable. Please let me know how you are proceeding on this issue and if you need further information.

D

0725.16 Corr-PS

4.1 1/2

WES MEETING : 3/21/85

PROPOSED WORKSHOP ON SUPERFUND SITES INVOLVING DREDGING AT WES (EARLY JULY). WES TO FORMALIZE BY NEXT WEEK

AL RANDALL: SPEAKING FOR NED.

ASSUME: NED WILL BE ISSUING A PERMIT.

∴ NED WILL BE LOOKING AT ALTERNATIVES DIFFERENTLY THAN EPA WOULD UNDER SUPERFUND. THEY MAY WANT A MORE DETAILED LOOK AT EVERY ALTERNATIVE SINCE THEY ARE ALL TECHNICALLY FEASIBLE (PARTICULARLY A NON-DREDGING OPTION).

NOTE: A PRIMARY ISSUE IS WHETHER WE ARE STILL LOOKING AT 6 ALTERNATIVES IN THE PRE-DESIGN, OR HAVE WE GOTTEN TO A POSITION WHERE WE CAN MOVE TO DREDGING WITH VARIOUS DISPOSAL OPTIONS.

New Bedford ~~Disposal~~ and Dredging Project
3-21-85

Name	ORGANIZATION	PHONE
Norman R. FRANCINGUES	WES-EE-S	601-634-3703
Ray Montgomery	WESEE	601-634 3416
William H. McAnally	WESHE	601-634-3822
Charles Bering	EPA, Region I, Regional Counsel/Off.	617-223-0400
ROBERT E. ADLER	EPA, Region I, Environ. Eval Sect.,	617-223-0829
Jackie Prince	EPA, Region I, Project Officer	617-223-195
Jerry Jones	WESEE-S	601-634-3857
Danny Averett	WESEE-S	601 634-3959
M. John Cullinane, Jr.	WESEE-S	601-634-3723
DICK LEE	WESES	601-634-3585
TOM HART	WIESES-A	601-634-3449 FTS 542-2935
Bob LAZOR	WESEP-D	601-634-2935
ALAN RANDALL	NEDOD-R	617-647-8494
JIM BRANNON	WESES-A	601-634-3725
Tommy Myers	WESEE-S	601-634-3939
JACK H. DILDINE	NESEE-S	(601) 634-2150
Dave Mathis	WRIC-D	703-385-3099
Joe Yeosted	NUS Corp.	(412)-788-1080
Tom Patin	WESEP-D	601-634-3444

E

NUTTER, McCLENNEN & FISH

ONE INTERNATIONAL PLACE
BOSTON, MASSACHUSETTS 02110-2699

617 439-2000

TELEX: 94-0790 TELECOPIER: 617 973-9748

September 13, 1989
11478-26

Secretary John DeVillars
Executive Office of Environmental Affairs
20th Floor
100 Cambridge Street
Boston, MA 02202

Re: New Bedford Harbor Federal Superfund Site
Public Notice in Environmental Monitor July 26, 1989
Site ID #4-1022

Dear Secretary DeVillars:

Pursuant to the Massachusetts Environmental Policy Act Regulations, 301 Code of Massachusetts Regulations 11.03(3), this is a request for your opinion as to whether the Proposed Plan for Cleanup for the First Operable Unit of the above project requires review under the Massachusetts Environmental Policy Act, G.L. c. 30, §§ 61-62H ("MEPA"). This firm and the other signatories to this letter represent potentially responsible parties at the above site, and we had anticipated, on the basis of the previously expressed opinions of the Department of Environmental Protection ("DEP"), the Environmental Protection Agency ("EPA"), and the MEPA Office of the Executive Office of Environmental Affairs ("EOEA"), that the project would undergo MEPA review.

DEP (then DEQE, hereinafter referred to as DEP) filed an Environmental Notification Form ("ENF") on September 15, 1986 (EOEA No. 6280). DEP withdrew the ENF on November 7, 1986. When DEP withdrew the ENF, its reason was that MEPA review would be premature because the technology for remediation was still under discussion with EPA. (See Attachment 1.) DEP did not then, and has not since then, asserted that this project is not subject to MEPA, and DEP tacitly acknowledged that the

clean-up project is subject to MEPA when DEP submitted the ENF. Obviously, an ENF is no longer premature.

On October 3, 1988, the Assistant Director of the MEPA Office pointed out to DEP that since the Record of Decision was expected to be issued in June 1989, prompt resubmission (of an ENF) was necessary "so that any needed environmental review can be timely and not delay" the clean-up. (See Attachment 2.) Thus EOEA, as well as DEP, recognized the applicability of MEPA to the clean-up of New Bedford Harbor.

EPA has also acknowledged MEPA jurisdiction. The EPA "Draft Final Hot Spot Feasibility Study, New Bedford Harbor," ("HSFS") dated July 1989 (enclosed herewith), states at page 4-6 that federal and state applicable or relevant and appropriate requirements (ARARs) for this site are identified in the "Regulation Assessment for New Bedford Harbor" by E.C. Jordan Co./Ebasco (1988) ("Regulation Assessment"). The Regulation Assessment (enclosed herewith), at page 95, identifies the Massachusetts Environmental Policy Act as applicable to this project. (Although E.C. Jordan/Ebasco were apparently unaware of the MEPA Regulations that took effect January 9, 1987, and therefore referred to the 1979 MEPA regulations, that oversight is unrelated to the issue of the applicability of MEPA).

Since DEP, EPA, and EOEA have all taken the position that MEPA applies to the project, we find inexplicable the failure of DEP and EPA to file an ENF and to list MEPA in the ARARs Summary Tables, Appendix B (unpaginated) to the HSFS. We also consider MEPA to be applicable, as both an ARAR and, more importantly, as an independent environmental law that requires review of this project.

MEPA is at the minimum a state requirement that is legally enforceable and consistently enforced statewide and therefore an ARAR under Section 121(d)(2)(c) of the Superfund Amendments and Reauthorization Act ("SARA"). 42 USC § 9621(d)(2)(c). EPA has taken the position that it need not comply with ARARs because it recently divided the clean-up into "operable units" (phases). The flaw in this theory is that the statutory section relied upon by EPA, 42 USC § 9621(d)(4)(A), provides that ARARs need not be met for phases if the project as a whole will comply with ARARs. No one knows what the entire clean-up will consist of, so that no one, including EPA and DEP, knows whether ARARs will be met by that project.

The fact that MEPA is not so limited as the chemical-, location-, and action-specific regulations setting out specific standards that are listed in Appendix B of the HSFS is illustrated by the procedure in 42 USC § 9621(d)(4)(A) for "catch-up" compliance with ARARs. For although it may be possible to take steps in subsequent stages of a clean-up to bring the project as a whole into compliance with standards-based ARARs, it is of course impossible to do the same with MEPA. This is so because the purpose of MEPA is to examine the environmental effects of a project before the project is implemented so that site-specific mitigation (not just compliance with existing regulatory requirements or standards) can be required if necessary. To say that MEPA is no more than an ARAR (and therefore not applicable to this stage of the clean-up) defeats its purpose: it is unrealistic to think that post-construction review will take place or that site-specific mitigation would even be considered after completion of this multi-million dollar project. As you know, MEPA is a broad-based environmental review procedure for disclosure and mitigation of potential harm from projects where state agencies have certain defined involvement. Therefore, EPA's rationale that they need not comply with ARARs does not excuse compliance with MEPA.

The fact that MEPA is broader than standards-based ARARs may explain its erroneous omission from the HSFS, but that omission does not obviate the requirement for compliance with MEPA. Nor is the requirement for compliance excused by SARA, 42 USC § 9621(e)(1), for that provision eliminates only the requirement for state permits. The MEPA procedure is not a permit. DEP's regulations do not substantively address the issue of compliance with MEPA. The Massachusetts Contingency Plan, 310 CMR 40.546(7)(c), Compliance with MEPA, states only that notice of the Final Remedial Response Plan must appear in the Environmental Monitor. The public notice requirement does not eliminate the concurrent requirements of the MEPA regulations for environmental disclosure and review.

The Proposed Plan for Cleanup ("project") is clearly subject to MEPA on several grounds. The project meets the Waterways Thresholds at 301 CMR 11.26(7)(b) 3, 4 and, apparently, 8. The dike (Confined Disposal Facility) that has already been constructed without MEPA review and as a part of the project is a solid fill structure of 1000 square feet or more base area, most of which is in the waters of New Bedford Harbor. See "New Bedford Harbor Superfund Pilot Study: Evaluation of Dredging and Dredged Materials Disposal," USACE, June 1989, ("USACE Report") (enclosed herewith) at 33. This

structure therefore meets the Review Threshold of 301 CMR 11.26 (7)(b)3. Construction of the dike involved dredging of 27,000 cubic yards and therefore met a second MEPA threshold. See USACE Report at 33; 301 CMR 11.26(7)(b)4. The dike was built on a bank and in the water, and it appears that alteration of 500 feet or more of waterway bank took place, thus meeting a third threshold, 301 CMR 11.26(7)(b)8.

In addition, if EPA chooses any of the alternatives proposed in the HSFS but "No Action," EPA will dredge five acres during the course of the project, which meets the 10,000 cubic yard dredging threshold of 301 CMR 11.26(7)(b)3. HSFS at 7-11, 7-29, 7-43.

Several of the alternatives also meet the Hazardous Materials Thresholds set out in 301 CMR 11.26(7)(g) because they include on-site treatment of hazardous materials and the total project cost exceeds $1 million.

Finally, it is highly likely that the project is categorically included under 301 CMR 11.25(8). EPA intends to use a public water supply for its hazardous waste incinerator but has not described the amount of water that it will use. As a comparison, the planned hazardous waste incinerator for Braintree was anticipated to use at least 100,000 gpd before undertaking special design features to bring its use down to 40,000 gpd because of the water shortage in Braintree. It is to be expected that the incinerator planned by EPA and DEP would use a comparable amount of water for their incinerator. Surely an apparent categorical inclusion cannot be ignored simply because the proponent has not calculated or provided the necessary data.

Since it appears that both EPA and DEP intend to proceed without complying with MEPA, and the review period for the HSFS ends on October 2, we respectfully request that you respond to this request before that date.

Sincerely,

Anne Smiley Rogers

Anne Smiley Rogers, for
AVX Corporation

Paul B. Galvani (AFR)

Paul B. Galvani
Eleanor D. Acheson, for
Aerovox, Inc.

David A. McLaughlin (ASR)
David A. McLaughlin for
Belleville Industries

Verne W. Vance, Jr. (ASR)
Verne W. Vance, Jr.,
Wendy Jacobs, for
Cornell Dubilier Electronics,

Howard Weir (ASR)
Howard Weir
Leslie Ritts, for
Federal Pacific Electric
Company

cc: Ellen M. Mahan, Esq.
Charles C. Bering, Esq.
Nancy Preiss, Esq.

9125L

S. Russell Sylva
Commissioner

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Solid and Hazardous Waste
One Winter Street, Boston, Mass. 02108

November 7, 1986

Secretary James Hoyte
Executive Office of
Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Dear Secretary Hoyte:

The Department of Environmental Quality Engineering is requesting the withdrawal of the New Bedford Harbor Environmental Notification Form #6280.

The Department is currently discussing with EPA the technical feasibility of alternate technologies for the remediation of New Bedford Harbor and MEPA review would be premature at this time.

Very truly yours,

James C. Colman

James C. Colman, Director
Office of Incident Response

JCC/lw

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

MICHAEL S. DUKAKIS
GOVERNOR

JAMES S. HOYTE
SECRETARY

MEMORANDUM

TO: James C. Colman, Director, DEQE/HW
FROM: Steven Davis, Assistant Secretary, MEPA Office SCD
DATE: October 3, 1988
SUBJECT: EOEA #6280 - New Bedford Harbor Cleanup

DEQE filed the New Bedford Superfund site with MEPA on 9/15/86. On November 7, 1986 DEQE withdrew the filing as premature, while discussions of a demonstration project with EPA were underway

We understand the ROD is due in June, 1989 and urge prompt resubmission to MEPA so that any needed environmental review can be timely and not delay the urgently needed clean up.

SCD/DES/bk